COMPARISON OF SEVOFLURANE AND PROPOFOL WITH FENTANYL FOR TRACHEAL INTUBATION WITHOUT MUSCLE RELAXANT

Dissertation submitted to

THE TAMILNADU DR. M.G.R.MEDICAL UNIVERSITY

in partial fulfillment for the award of the degree of

DOCTOR OF MEDICINE

IN

ANAESTHESIOLOGY

BRANCH X

INSTITUTE OF ANAESTHESIOLOGY & CRITICAL CARE

MADRAS MEDICAL COLLEGE

CHENNAI- 600 003

APRIL 2013

DECLARATION

I hereby declare that the dissertation entitled **"COMPARISON OF SEVOFLURANE AND PROPOFOL WITH FENTANYL FOR TRACHEAL INTUBATION WITHOUT MUSCLE RELAXANT"** has been prepared by me, under the Guidance of **Prof.Dr.T.VENKATACHALAM, M.D.,D.A.,** Professor of Anaesthesiology, Institute of anaesthesiology and critical care, Madras Medical College, Chennai, in partial fulfillment of the regulations for the award of the degree of M.D[Anaesthesiology], examination to be held in April 2013.

This study was conducted at Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai.

I have not submitted this dissertation previously to any university forthe award of any degree or diploma.

Date :
Place : Chennai **Dr. M.PREM KUMAR**

CERTIFICATE

This is to certify that the dissertation entitled, "**COMPARISON OF SEVOFLURANE AND PROPOFOL WITH FENTANYL FOR TRACHEAL INTUBATION WITHOUT MUSCLE RELAXANT",**Submitted by **Dr. M.PREM KUMAR** in partial fulfilment for the award of the degree of Doctor of Medicine in Anaesthesiology by the Tamilnadu Dr. M.G.R. Medical University, Chennai is a bonafide record of the work done by him in the INSTITUTE OF ANAESTHESIOLOGY & CRITICAL CARE, Madras Medical College, during the academic year 2011-2013.

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CERTIFICATE OF APPROVAL

To

Dr. M. Prem Kumar
PG in MD Anaesthesia
Madras Medical College, Chennai -3

Dear Dr. M. Prem Kumar

The Institutional Ethics Committee of Madras Medical College reviewed and discussed your application for approval of the proposal entitled "Comparison of sevoflurance and propofol with fentanyl for tracheal intubation without muscle relaxant" No. 25052012.

The following members of Ethics Committee were present in the meeting held on 30.05.2012 conducted at Madras Medical College, Chennai -3.

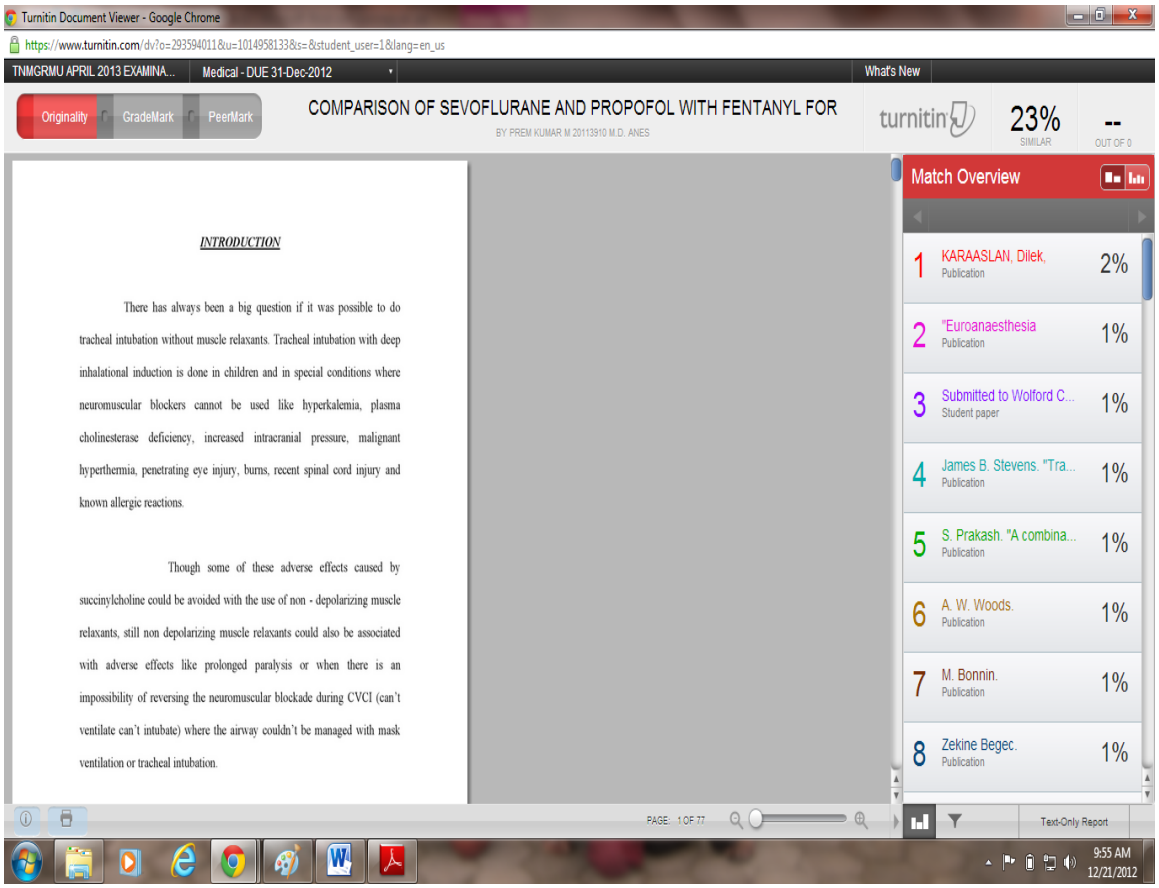
1.	Prof. S.K. Rajan, MD	-- Chairperson
2.	Prof. Pregna B. Dolia MD Vice Principal , Madras Medical College, Chennai -3 Director , Instt.of Bio Chemistry, MMC, Ch-3	-- Member Secretary
3.	Prof R. Nandhini, MD Director, Institute of Pharmacology, MMC, Ch-3	-- Member
4.	Prof. P. Karkuzhali MD Director i/c Prof & Head , Dept. of Pathology, MMC, Ch-3	-- Member
5.	Prof.A. Radhakrishnan MD Prof. of Internal Medicine, MMC, Ch-3	-- Member
6.	Prof. P. Raghumani MS Prof. of Surgery, Dept. of Surgery, MMC, Chennai -3	-- Member
7.	Thiru. S. Govindasamy . BA.BL	-- Lawyer
8.	Tmt. Arnold Soulina MA	-- Social Scientist

We approve the proposal to be conducted in its presented form.

Sd /. Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, any SAE occurring in the course of the study, any changes in the protocol and patient information / informed consent and asks to be provided a copy of the final report

Member Secretary, Ethics Committee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INTRODUCTION
There has always been a big question if it was possible to do tracheal intubation without muscle relaxants. Tracheal intubation with deep inhalational induction is done in children and in special conditions where neuromuscular blockers cannot be used like hyperkalemia, plasma cholinesterase deficiency, increased intracranial pressure, malignant hyperthermia, penetrating eye injury, burns, recent spinal cord injury and known allergic reactions.
Though some of these adverse effects caused by succinylcholine could be avoided with the use of non - depolarizing muscle relaxants, still non depolarizing muscle relaxants could also be associated with adverse effects like prolonged paralysis or when there is an impossibility of reversing the neuromuscular blockade during CVCI (can't ventilate can't intubate) where the airway couldn't be managed with mask ventilation or tracheal intubation.
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INTRODUCTION

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Though some of these adverse effects caused by succinylcholine could be avoided with the use of non - depolarizing muscle relaxants, still non depolarizing muscle relaxants could also be associated with adverse effects like prolonged paralysis or when there is an impossibility of reversing the neuromuscular blockade during CVCI (can't ventilate can't intubate) where the airway couldn't be managed with mask ventilation or tracheal intubation.

Some neuromuscular disorders for example myasthenia gravis alter the clinical pharmacology of muscle relaxants and

can cause alterations in the dosage, choice, and reversal of the muscle relaxant. Hence in these scenarios, tracheal intubation free of neuromuscular blocking agents is frequently done.[1]

This technique is also useful where neuromuscular blockade is not needed to facilitate surgical access like ambulatory surgery.[2,3] Neurosurgical procedures which needs evoked potential monitoring and some surgical procedures such as facial nerve exploration and few thyroid surgeries which may necessitate the use of nerve stimulator for identification of nerves and confirmation of their integrity, a neuromuscular block free based intubation is required.

Various techniques of induction can be used to achieve tracheal intubation free of neuromuscular blockade. Intravenous or inhalational induction can be used. A bolus dose propofol without concomitant opioid has been used in the past for tracheal intubation but because of inferior intubating conditions, it was used with concomitant fentanyl which lead to better intubating conditions.[4]

Upper airway reflexes were more depressed with propofol compared with thiopentone while performing laryngoscopy when given in an equipotent dose which is the reason for its use for facilitating laryngeal mask airway placement. Propofol was found to have better intubating conditions compared to thiopentone when combined with remifentanil.[5,6]

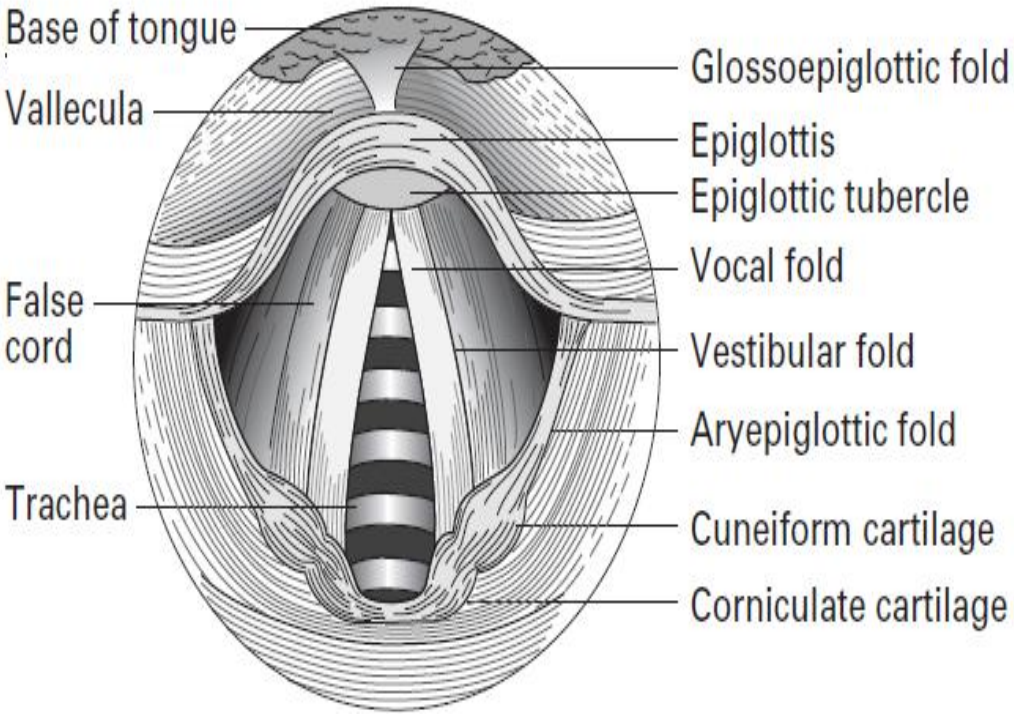
High concentrations of sevoflurane is usually used in children for intubation without neuromuscular blockade.[7] Sevoflurane has been studied to be a preferred agent in adults for anesthetic induction and it can be used alone or with nitrous oxide.[8] Both sevoflurane and propofol induction has been used in management of difficult airway.[9] But sevoflurane has its advantage in the maintenance of spontaneous ventilation. Sevoflurane mask induction has been studied with adjuvants like midazolam or fentanyl and has been shown in the reduction of time to obtain optimal intubating conditions in adults.[10]

The aim of our study was to determine if sevoflurane – fentanyl combination would offer equivalent intubating conditions when compared with propofol – fentanyl combination.

AIM

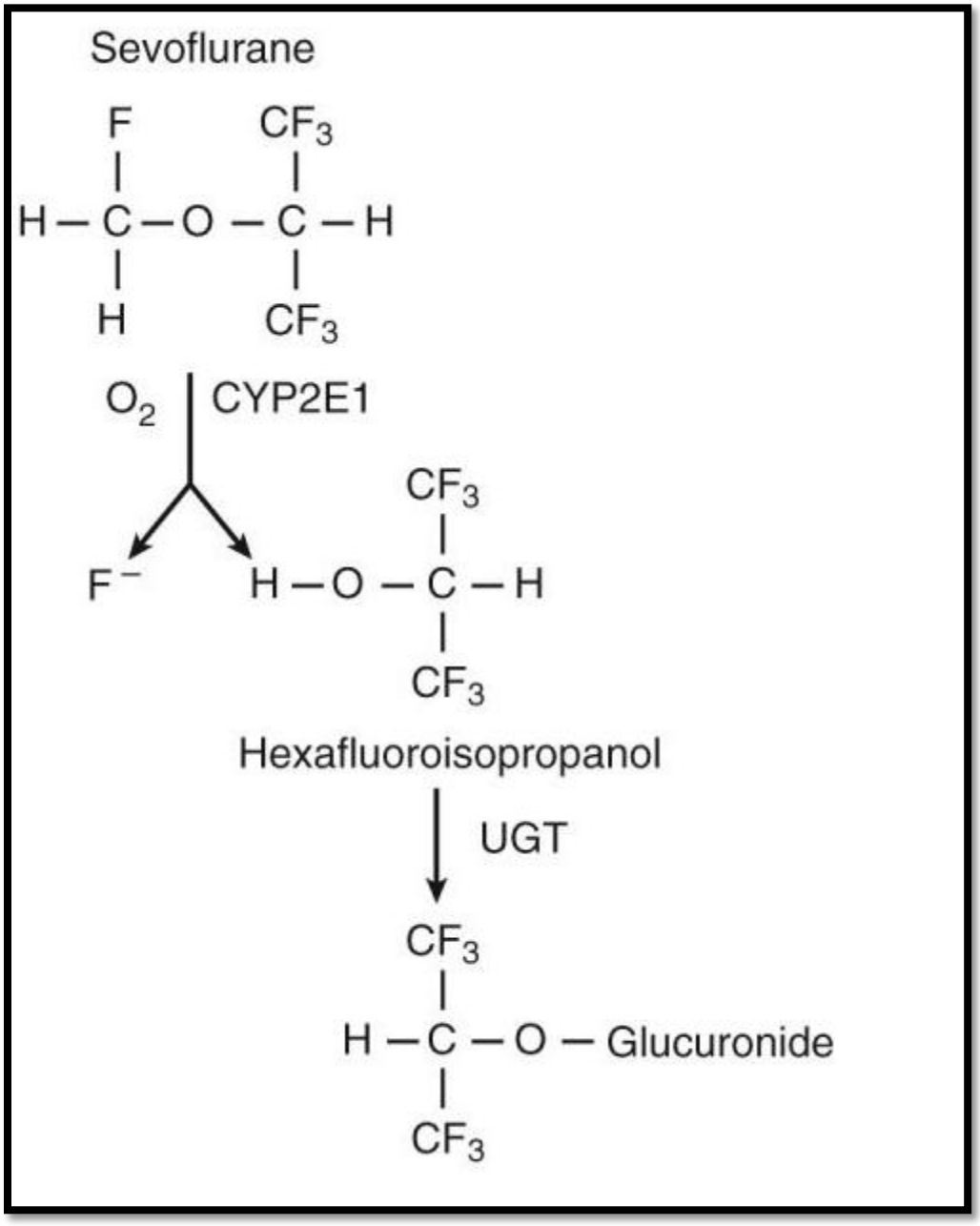
Aim of the study was to compare the effectiveness of sevoflurane and propofol with fentanyl for tracheal intubation without muscle Relaxant.

VIEW OF LARYNX AT LARYNGOSCOPY



PHARMACOLOGY

SEVOFLURANE:



Sevoflurane is a halogenated fluoride. Sevoflurane has blood gas solubility of 0.69 and MAC value of 2% and together with its non-pungent odour and rapid increase in alveolar concentration makes it a better choice for smooth and rapid induction of agent in both pediatric and adult patients. An advantage is its rapid emergence because of its low blood gas solubility. Inhalational induction can be done with 8% sevoflurane in a 50% mixture of nitrous oxide and oxygen and tracheal intubation could be obtained in 1–3 minutes. Delirium associated with sevoflurane can be treated with 1-2 µg/kg fentanyl.

Cardiovascular effects

- Sevoflurane causes mild depression of myocardial contractility.
- Systemic vascular resistance and blood pressure falls slightly less than with isoflurane or desflurane.
- In contrast to isoflurane and desflurane, sevoflurane doesn't alter heart rate or cause cardiovascular stimulation during rapid increases in anesthetic concentration in humans.
- It maintains cardiac output because sevoflurane produce less reduction in myocardial contractility and greater decreases in systemic vascular resistance

Respiratory effects

It depresses respiration and hypoxic ventilatory drive. It also reverses bronchospasm becauses of its bronchodilator property although less than halothane.

CNS effects

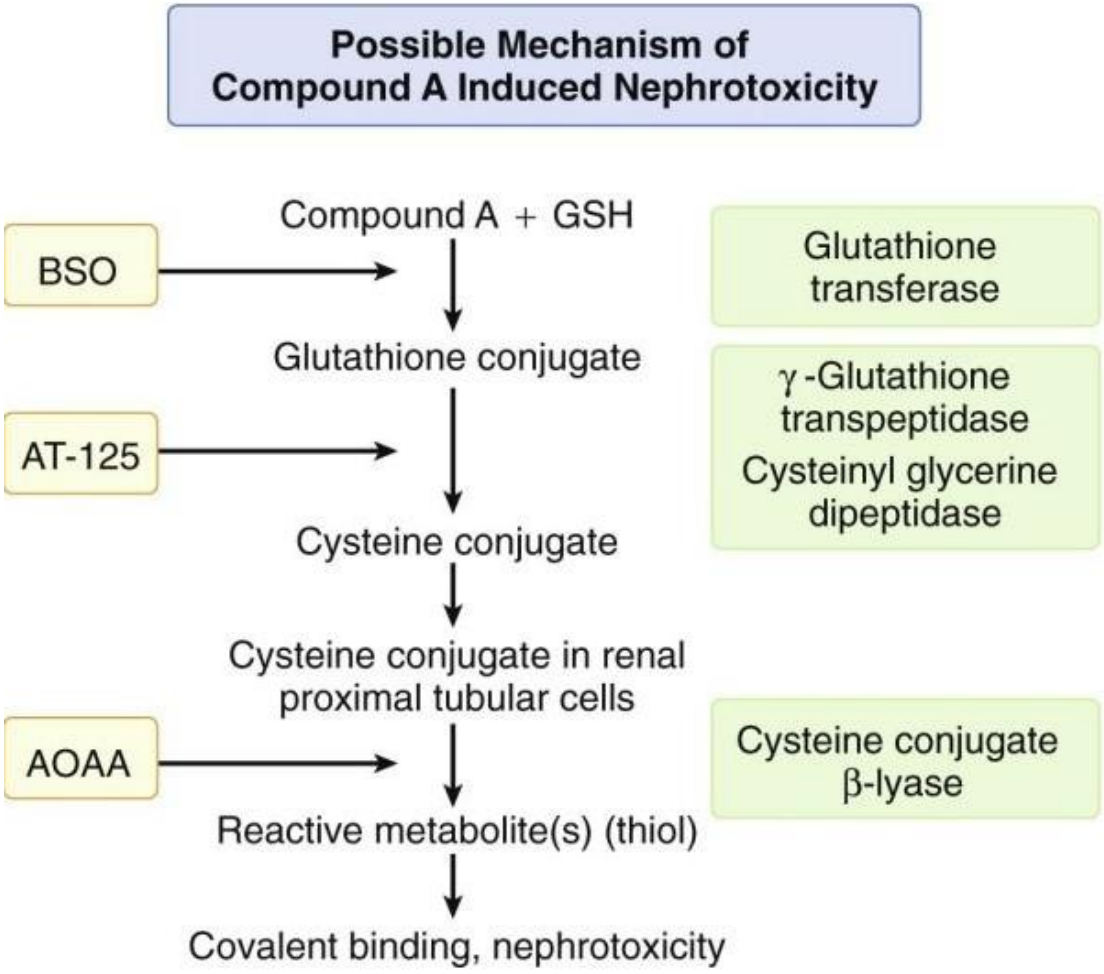
Sevoflurane causes slight increase in cerebral blood flow and intracranial preesure. Autoregulation of cerebral blood flow may be impaired when used in concentration of > 1.5 MAC.

Neuromuscular action

Sevoflurane produces adequate muscle relaxation for intubation following an inhalation induction.

Renal effects

- Sevoflurane slightly decreases renal blood flow.
- High fluoride levels and compound A can be associated with impaired renal tubule function.



(Buthionine-(S,R)-sulfoximine (BSO), acivicin (AT-125), and aminooxyacetic acid (AOAA) inhibits the activity of β-lyase)

- Sevoflurane has less nephrotoxic potential which was indicated by urine-concentrating ability and the production of *N*-acetyl-β-glucosaminidase (NAG), an indicator of renal tubular damage.

- Compound A is formed by the interaction of sevoflurane and soda lime under low flow anesthesia.

Hepatic effects

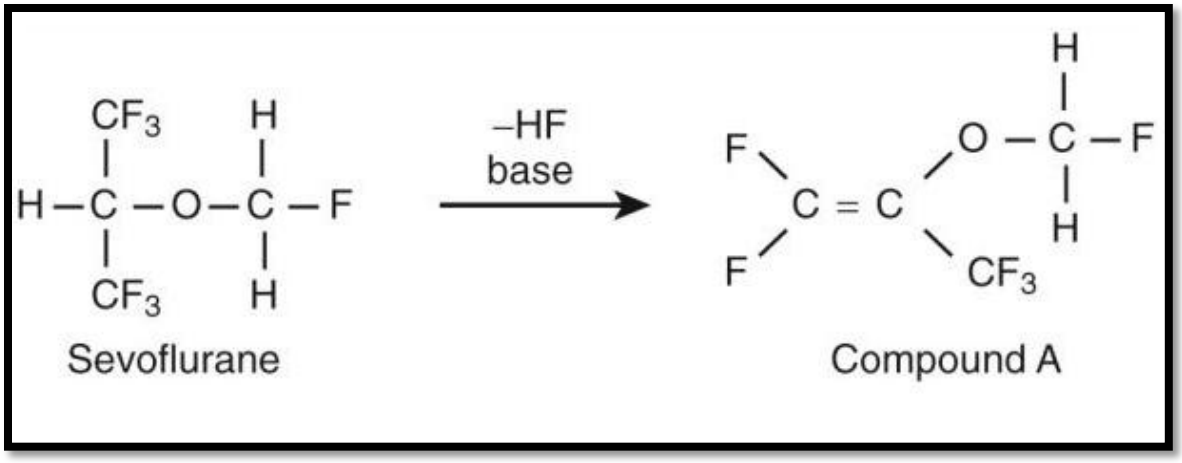
Though it decreases portal vein blood flow, it also increases hepatic artery blood flow, thus maintaining the total hepatic blood flow and oxygen delivery.

Metabolism

Sevoflurane is metabolized by liver microsomal enzyme P-450-2E1. There is no association with peak fluoride levels following sevoflurane administration and renal concentrating abnormality.

Compound A

Fluoromethyl-2-2-difluoro-1-(trifluoromethyl) vinyl ether (compound A) is the major degradation product of sevoflurane. The dehydrofluorination of sevoflurane to form compound A is initiated by soda lime abstraction of a proton from the isopropyl group of sevoflurane.



In a rebreathing system with a carbon dioxide absorber in lime (soda lime or Baralyme), patients exposed to sevoflurane will breathe compound A. The typical levels seen in clinical conditions will vary and are dependent on several factors, the most important being the inspired fresh gas flow rate.

The key factor in determining potential toxicity from sevoflurane is total exposure rather than the absolute concentration, with exposure being expressed as the product of concentration and time.

At a fresh gas inflow of 2 L/min, these levels would be expected to be seen only in conditions of prolonged sevoflurane exposure and are not of concern to the vast majority of patients undergoing anesthesia

Inhalational induction

There are 3 types of inhalational induction:

- VIMA(volatile induction and maintenance of anesthesia)
- Overpressure induction(vital capacity breath induction)
- Incremental induction

Many techniques can be followed for inhalational induction for tracheal intubation.

1. First method is induction with sevoflurane 8% and N2O 66%;

2. Second method is induction with oxygen 100% and sevoflurane 8%.

3. Studies indicate that the average time for sevoflurane and oxygen 100% combination was 6.4 min, and sevoflurane and nitrous oxide 66% combination was 4.7 min.

4. Hence it is found that a longer period is needed in adults even when induction is done with sevoflurane 8%.

Inhalation of volatile agents was an age old technique of administering anesthesia. It is useful in situations where is a lack of venous access and anticipated airway difficulty.

A major advantage of inhalational induction of anesthesia is the maintenance of spontaneous ventilation although there could be associated respiratory and cardiovascular effects which occur gradually as the depth of anesthesia is increased. It needs good facemask ventilation to prevent leaks around the mask and to prevent airway obstruction.

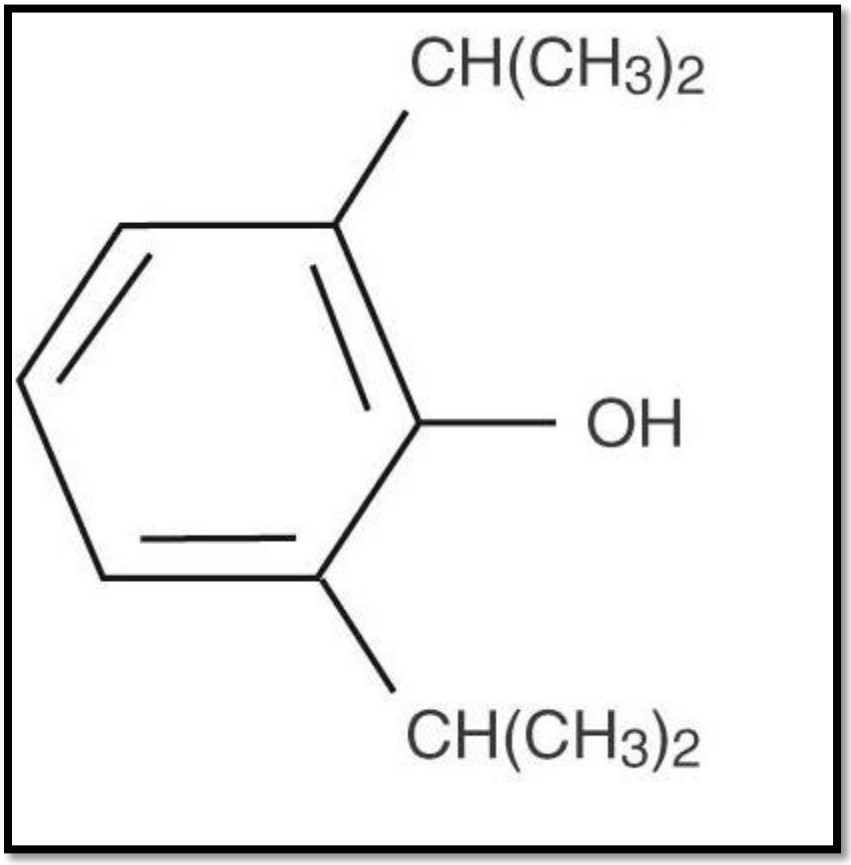
Deep anesthesia is needed for laryngoscopy and tracheal intubation with volatile agents alone. Sevoflurane has muscle relaxant property which allows the insertion of laryngeal mask airway (LMA) or endotracheal tube. A depth of anesthesia that allows controlled ventilation has been recommended when sevoflurane is used.

Increased depth of anesthesia can cause complications like hypoventilation, obstruction, hypotension and bradycardia due to cardiovascular depression. Prior administration of topical anesthesia with 4% lidocaine can facilitate tracheal intubation under inhaled anesthesia. Clinical end points for tracheal intubation are loss of lid lash reflex and convergence of pupils to midline.

Sevoflurane has advantages over other volatile anesthetics for inhaled induction of anesthesia because it has a low blood-gas partition coefficient and non-pungent odour which facilitates rapid and smooth attainment of a depth of anesthesia sufficient for airway procedures.

A rapid technique (“single breath”) in which the patient breathes 8% sevoflurane from a primed anesthesia circuit has been used for faster induction but it causes apnea more frequently than the incremental induction. Inhaled induction of anesthesia is very useful in a wide variety of difficult airway conditions.

PROPOFOL



- Propofol belongs to the group of alkylphenols(2,6-diisopropylphenol). They are oils and are insoluble in aqueous solution but is highly lipid soluble.

- The formulation consists of 1% propofol, 10% soybean oil, 2.25% glycerol, and 1.2% purified egg phosphatide. Because of the concern

of microbial growth in the emulsion, disodium edetate (0.005%) was added for antibacterial action.

- It has a pH of 7 and appears as a slightly viscous, milky white substance.

- This formulation can cause pain during injection which can be reduced by prior administration of lidocaine (2 mL of 1% lidocaine in 18 mL propofol).

- Pretreatment with a small dose of opiates, nonsteroidal anti-inflammatory drugs, ketamine, esmolol/metoprolol, magnesium, clonidine/ephedrine combination, dexamethasone, and metoclopramide have been studied but with variable efficacy.

- Propofol is used for induction and maintenance of anesthesia and for sedation in and outside the operating room.

- Fospropofol, a phosphorylated prodrug of propofol, has a unique pharmacokinetic and pharmacodynamic profile. Fospropofol has a little longer time for its peak effect and more prolonged pharmacodynamic effect compared with propofol.

Metabolism

Propofol is rapidly metabolized in the liver by conjugation to sulfate and glucuronide which are excreted by the kidneys. Lungs are the site of extrahepatic metabolism.

Pharmacokinetics of propofol.

Elimination	Elimination Half-Life (hr)	Clearance (mL/kg/min)	Vd_{SS} (L/kg)
Propofol	**4-7**	**20-30**	**2-10**

After a single bolus dose, the concentration of propofol in blood decrease rapidly as a result of redistribution and elimination. The initial distribution half-life of propofol is 2 to 8 minutes.

Cardiovascular effects

- The major cardiovascular effect of propofol is hypotension which is due to reduction in systemic vascular resistance, preload and myocardial contractility.
- Hypotension is more pronounced with propofol than thiopentone and it also impairs the baroreceptor reflex. Large dose, rapid injection and old age are the factors which exacerbates hypotension.

- Changes in cardiac output and heart rate are usually transient in healthy patients but can be severe in patients with old age and in patients who are on negative chronotropic medications.

- Patients with impaired ventricular function may have a significant reduction in cardiac output as a result of reduction in ventricular filling pressures and contractility.

- Myocardial oxygen consumption and coronary blood flow decreases indicating an imbalance between myocardial oxygen supply and demand.

Respiratory effects

- Propofol is a profound respiratory depressant which usually causes apnea following an induction dose.
- Propofol infusion inhibits hypoxic ventilatory drive and depresses the response to hypercarbia.
- Propofol gives superior jaw relaxation and reduction of pharyngeal and laryngeal reflexes than thiopentone which is the reason for its use during tracheal intubation or for the placement of laryngeal mask

airway in the absence of muscle relaxant. It is not contraindicated in asthmatic patients.

Cerebral effects

- Propofol decreases intracranial pressure due to its action on the cerebral blood flow by reducing it.
- Propofol can cause a critical reduction in cerebral perfusion pressure(CPP) < 50 mm Hg in patients with increased intracranial tension thus mandating adequate maintenance of mean arterial pressure.

- Propofol and thiopental provides similar degree of cerebral protection during focal ischemia. Propofol has antipruritic properties and antiemetic effects making it the preferred drug for day care surgery.
- Propofol has anticonvulsant properties (ie, burst suppression), it has been successfully used to terminate status epilepticus, and can be safely administered to epileptic patients. Tolerance does not develop after long-term propofol infusions.

Drug Interactions

Fentanyl and alfentanil concentrations may be increased by concomitant administration of propofol.

Dosage of Intravenous Propofol

Induction of general anesthesia	1-2.5 mg/kg IV dose reduced with increasing age
Maintenance of general anesthesia	50-150 µg/kg/min IV combined with N_2O or an opiate
Sedation	25-75 µg/kg/min IV
Antiemetic dose	10-20 mg IV, can repeat every 5-10 min or start infusion of 10 µg/kg/min

Uses

- Propofol, when used for induction of anesthesia in briefer procedures, results in a significantly quicker recovery and an earlier return of psychomotor function compared with thiopental.

- Propofol provides a rapid recovery and is superior to barbiturates for maintenance of anesthesia, and it seems to be equal to enflurane, isoflurane and sevoflurane.

- When combined with propofol, the required infusion rate and concentration of opioids is reduced. Because opioids alter the concentration of propofol required for adequate anesthesia, the relative dose of either opioid or propofol markedly affects the time from termination of drug to awakening and recovery.

Side Effects and Contraindications

Induction of anesthesia with propofol is associated with several side effects which includes:

- Hypotension
- Pain on injection
- Myoclonus
- Respiratory depression
- Thrombophlebitis.

Intravenous induction

- Propofol is the intravenous induction agent which attenuates the pharyngeal and laryngeal reflexes which is the reason for its use during tracheal intubation or for the placement of laryngeal mask airway in the absence of muscle relaxant.
- Studies indicate that when propofol is combined with opioids, acceptable intubating conditions is obtained.
- Either increasing the propofol dose to 2.5 or 3 mg/kg or increasing the dose of fentanyl to 2 – 3 µg/kg would provide excellent intubating conditions in patients. Disadvantage is the exacerbation of hypotension and apnea associated with the high dosage.

De Fatima et al. reported that fentanyl 3 microgram/kg given 5 min prior to induction of propofol 3 milligram/kg resulted in acceptable intubation conditions in 75% of patients. This was compared with propofol 2.5 mg/kg and 3.5 mg/kg where the acceptable intubating conditions were 20% and 80% respectively. Hence they concluded that propofol 3 mg/kg and fentanyl 3 µg/kg was the ideal dose for tracheal intubation without muscle relaxants.

FENTANYL

Mechanisms of Action

Opioids bind to specific receptors which are located throughout the central nervous system and other tissues. Four major types of opioid receptor have been identified : mu, kappa , delta, and sigma .

Opioids are effective in producing analgesia though they provide only minimal degree of sedation, The pharmacodynamic properties of specific opioids depend on which receptor is bound, the binding affinity, and whether the receptor is activated.

Opioids inhibit the presynaptic release and postsynaptic response to excitatory neurotransmitters from nociceptive neurons. Pain impulses could be interrupted at the level of the dorsal horn of the spinal cord with intrathecal or epidural administration of opioids. Modulation of a descending inhibitory pathway from the periaqueductal gray through the nucleus raphe magnus to the dorsal horn of the spinal cord also plays a role in opioid analgesia.

Pharmacokinetics

- Oral transmucosal fentanyl citrate absorption is an effective method of producing analgesia and sedation and provides rapid onset (10 min) of analgesia and sedation in children (15–20 μg/kg) and adults (200 – 800 μg/kg).
- Fentanyl is lipid soluble which is the reason for its rapid onset and short duration of action.
- Most opioids depend primarily on the liver for biotransformation.
- The lungs exert a significant first-pass effect and transiently take up approximately 75% of an injected dose of fentanyl. Approximately 80% of fentanyl is bound to plasma proteins, and significant amounts (40%) are taken up by red blood cells.
- They have a high hepatic extraction ratio, hence their clearance depends on liver blood flow.

Effects on Organ Systems

- Opioids impair cardiovascular function very minimally.
- High doses of fentanyl are associated with a vagus-mediated bradycardia

- Opioids depress ventilation, especially the respiratory rate. Resting $PaCO_2$ increases and the response to a CO_2 challenge is attenuated, resulting in a shift of the CO_2 response curve downward and to the right.
- The apneic threshold—the highest $PaCO_2$ at which a patient remains apneic is elevated on administration of opioids, and hypoxic drive is decreased.
- Opioids can induce chest wall rigidity severe enough to prevent adequate ventilation. This effect is centrally mediated and occurs most often after large bolus dose and it can be effectively treated with muscle relaxants. Opioids can effectively attenuate the intubation response due to laryngoscopy.
- Opioids reduce cerebral oxygen consumption, cerebral blood flow, and intracranial pressure, although less than barbiturates or benzodiazepines.
- Opioids slow gastric emptying time by reducing peristalsis. Biliary colic may result from opioid-induced contraction of the sphincter of Oddi.
- Opioids reduce the stress response to surgical stimulus.

USES:

- For analgesia – bolus dose of 2 - 6 µg/kg and Infusion rates range from 0.01 to 0.05 µg/kg/min.
- Opioids interact synergistically and it reduces the dose of propofol and other sedative-hypnotics required for loss of consciousness and during noxious stimulation such as skin incision.
- The purpose of using opioids was producing anesthetic conditions with hemodynamic stability.
- The plasma concentration of fentanyl required for postoperative analgesia was approximately 1.5 ng/mL.
- The MAC requirement of various volatile agents are reduced by opioid administration.

REVIEW OF LITERATURE

The literature was searched and the studies which were conducted comparing inhalational induction with sevoflurane and intravenous induction with propofol in elective patients undergoing general anesthesia was reviewed.

1. ***Karaaslan et al.*** compared whether propofol and sevoflurane with remifentanil without muscle relaxant would yield equivalent intubation conditions.

   80 patients of ASA physical status I,II were randomly allocated into 2 groups. Patients were induced with sevoflurane 8 % in group 1 and propofol 1 milligram/kg/min in group 2 until bispectral index was less than 60. Intubation was done when BIS was < 60. All patients received remifentanil infusion at a dose of 1 µg/kg/min.

   Intubating conditions assessment were graded as excellent, good, marginal, poor using vocal cord opening, limb movement and jaw relaxation. Heart rate and mean arterial blood pressure were recorded before induction, and during induction, and

1 min after intubation, 2 after intubation and 5 minutes following intubation. The duration of time for bispectral index to become less than 60 was recorded.

Optimal intubating conditions were better in group II compared with group I - 90% vs 45%. The ratio of patients showing successful ratio(optimal or good) intubating conditions was 80% and 100% in groupI and group II .

The duration of time required for bispectral index to become less than 60 was reduced in group II than in group I (47.1±27.2 sec vs. 111.9±60.6 sec). Mean arterial pressure and heart rate showed a significant decrease compared to baseline in both the groups.

They concluded that under BIS monitoring, propofol and remifentanil offered better intubation conditions and shorter induction period compared with sevoflurane and remifentanil.

(J Clin Exp Invest Vol 2, No 2, June 2011.)

2. ***Scheller et al.*** compared propofol at a dose of 2 mg/kg with different doses of alfentanil 30**,** 40, 50, or 60 µg/kg for tracheal intubation without muscle relaxant to evaluate airway and the intubating conditions.

75 patients with ASA I or II with Mallampati grade I airway were chosen. Patients were randomly assigned into 5 groups. There were 15 patients in each group. Patients in group I received thiamylal 4 mg/kg, tubocurare 3 mg and succinylcholine 1 mg/kg. Patients in groups II-V received propofol at a dose of 2 mg/kg with different doses of alfentanil 30, 40, 50, or 60 μg/kg. Muscle relaxant was avoided in groups II-V.

Jaw mobility and ease of ventilation were recorded. 90 seconds after induction, laryngoscopy was done and the glottic exposure and the vocal cord position were recorded. Patient response was noted after intubation. Heart rate and arterial blood pressure were recorded before and after induction, and after intubation of the trachea.

Ease of ventilation was good and jaw was relaxed in all the patients. 5 patients in group II(30 μg/kg) couldn't be intubated because of poor exposure or closure of vocal cords. In all other groups, position of vocal cord was favorable for intubation compared with group II.

Heart rate and arterial blood pressure had a significant decrease after induction compared with preinduction values. But there

were no difference between the alfentanil groups. Patients in group I had significant increase in heart rate after induction compared with preinduction values. Patients in group I had significant rise in mean arterial pressure after laryngoscopy and intubation compared with postinduction values.

They concluded that patients receiving propofol for induction and alfentanil(>30 *µg/kg)*,mask ventilation,jaw mobility, vocal cord position and exposure during laryngoscopy and patient response to intubation differs minimally compared with thiamylal and succinylcholine.

(Anesth Analg 1992; 75; 788-793.)

3. ***Grant et al.*** assessed the intubating conditions in adults with propofol induction and varying doses of remifentanil.

   60 patients of ASA I or II were randomly assigned into 3 groups. They assessed the intubating conditions in three groups after induction with propofol 2 mg/kg and various doses of remifentanil. Remifentanil doses given were 0.5, 1.0 or 2.0 µg/kg. Ease of laryngoscopy, jaw relaxation, coughing, position of vocal cords and limb movement were assessed.

Success rate of intubation was 80%, 90% and 100% with remifentanil doses of 0.5, 1.0 or 2.0 µg/kg respectively. Acceptable intubating conditions were present in 20%, 50% and 80% of patients. All three groups had a reduction in arterial blood pressure post induction but there was no difference between groups.

They concluded that the intubating conditions were better after induction with propofol at a dose of 2 mg/kg and remifentanil at a dose of 2 µg/kg.

(Br. J. Anaesth. (1998) 81(4): 540-543)

4. ***Sivalingam et al.*** studied the intubating conditions and the hemodynamic changes after induction of sevoflurane nitrous oxide in 3 different doses of alfentanil with low-dose alfentanil and suxamethonium.

   Patients were randomly assigned into four groups. They assessed the intubating conditions after inducing the patient with vital capacity breaths of sevoflurane 8% and 60 % nitrous oxide in 4 groups receiving alfentanil of 20, 25, 30 µg/kg and alfentanil 10 µg/kg and succinylcholine 1 mg/kg.

   Intubating conditions were excellent in 83%, 80%, 92% and 96% of patients in groups with alfentanil 20, 25, 30 µg/kg

and alfentanil 10 µg/kg and succinylcholine 1 mg/kg respectively. Laryngoscopy and tracheal intubation induced increase in heart rate significantly decreased in all the groups.

There was a significant decrease in mean arterial pressure after induction in all groups. Mean arterial pressure increased significantly 2 minutes after intubation compared with post induction value in alfentanil with succinylcholine group.

They concluded that the intubating conditions obtained with sevoflurane plus alfentanil 30 µg/kg were comparable to those provided by the sevoflurane, alfentanil 10 µg/kg and suxamethonium combination.

(Anaesth Intensive Care. 2001 Aug;29(4):383-7)

5. ***Katoh et al.*** aimed at determining the effect of fentanyl administration before tracheal intubation on the MAC-TI of sevoflurane.

   80 patients of ASA I or II were randomized into 4 fentanyl groups – 0, 1, 2 ,4 µg/kg. This study was done to determine whether fentanyl would affect sevoflurane requirement for achieving 50% probability of nil movement in response to laryngoscopy and intubation (MAC-TI). All the patients were induced with sevoflurane

at a pre-selected end-tidal concentration according to dixon's up and down technique.

Fentanyl administered after steady state sevoflurane concentration was maintained for at least 10 min and tracheal intubation was done 4 min after administration of fentanyl, and patients were assessed for movement. Heart rate (HR) and mean arterial pressure (MAP) were recorded before induction, fentanyl administration, laryngoscopy and after intubation.

The authors found no difference in the sevoflurane requirement significantly between fentanyl 2 and 4 µg/kg indicating that fentanyl has a ceiling effect. The MAC-TI of sevoflurane in this study was 3.55% (95% confidence intervals 3.32-3.78%), and this was reduced to 2.07%, 1.45% and 1.37% by addition of fentanyl 1, 2 and 4 µg/kg. Fentanyl attenuated heart rate and MAP (mean arterial blood pressure) due to intubation which was dose dependent even with decreasing concomitant sevoflurane concentration. Fentanyl 4 µg/kg attenuated the hemodynamic changes(HR and MAP) more effectively than fentanyl 1 or 2 µg/kg at sevoflurane concentrations close to MAC-TI.

(Br J Anaesth. 1999 Apr;82(4):561-5.)

6. ***Kimura et al***. aimed at determining the concentration of sevoflurane required for mean alveolar concentration(MAC) and for tracheal intubation (MAC-TI) in adults.

86 elective patients of ASA physical status I and II were selected. After maintaining the pre-selected end tidal concentration of sevoflurane for 20 min, intubation was done without muscle relaxant for MAC-EI determination. Pre-determined concentration sevoflurane at which intubation was done was - 2.5%, 3.0%, 3.5%, 4.0%, 4.5%, 5.0%, 5.5%, 6.0%, 6.5%, and 7.0%. After maintaining the pre-selected end tidal concentration of sevoflurane for 20 min, skin incision was attempted. Pre-determined concentration sevoflurane at which skin incision was attempted was 0.5%, 1.0%, 1.5%, 2.0%, 2.5%, and 3.0%.

They determined the MAC-EI of sevoflurane to be 4.52% (95% confidence limits, 3.91%-5.21%), and the ED95 for tracheal intubation was 8.07%. The MAC of sevoflurane was 1.58% (95% confidence limits, 1.14%-1.98%), and the AD95 (anesthetic ED95) was 2.96%. The MACEI/MAC ratio was 2.86 (95% confidence limits, 2.63-3.43).

They concluded that induction followed by tracheal intubation without muscle relaxant can be accomplished in adults when sevoflurane is given as a single anesthetic but in excess of 8% end-tidal concentration.

(Anesth Analg August 1994 79:378-381.)

7. ***Van Twest et al.*** assessed the effectiveness of bispectral index monitoring as a guide to the time of intubation during sevoflurane induction without the use muscle relaxants in adults, and to determine whether a bispectral index value of 25 would yield better intubating conditions than a bispectral index of 40.

   Forty patients were randomized into two groups, a target bispectral index of 25 or a target bispectral index of 40. Patients were premedicated with midazolam 20 µg/kg, fentanyl 0.5 µg/kg. Induction with Sevoflurane was initiated and titrated to reach the target BIS value and maintained within the target range for two minutes. The trachea was intubated and the intubating conditions were assessed.

   The bispectral index 25 group had a superior median intubating score of 4 (range 3-9) compared with the Bispectral index 40 group with a median of 7 (5-10, [6-9], $P<0.001$). The time to reach

target BIS values was not statistically different (BIS 25 group - 6.6 min, BIS 40 group - 5.1 min, P=0.054).

End-tidal sevoflurane concentration upon reaching the target BIS was higher in the BIS 25 group (5.3% +/- 1.2%) vs the BIS 40 group (3.5% +/- 0.95) (P<0.001). There was no statistical difference in the heart rate and arterial blood pressure between the 2 groups.

They concluded that target Bispectral index value of 25 provides better intubating conditions than target Bispectral index value of 40 during induction with sevoflurane without neuromuscular blocking agents.

(Anaesth Intensive Care. 2006 Oct;34(5):606-12.)

8. ***Taha et al.*** compared the intubation conditions and hemodynamic changes after induction and tracheal intubation in patients who were either propofol – remifentanil - lidocaine or thiopental – remifentanil - lidocaine.

   The study group consisted of 76 healthy patients who were randomly allocated into 2 groups: group P received and propofol at a dose of 2 mg/kg, remifentanil 2 μg/kg and lidocaine 1.5 mg/kg, or group T received thiopental 5 mg/kg, lidocaine 1.5 mg/kg,

remifentanil 2 μg/kg. Laryngoscopy and intubation was done 90 seconds after administration of the hypnotic agent.

Intubation conditions were determined as excellent, good or poor with jaw relaxation, ease of ventilation, vocal cord position, and the patient's response to intubation and tracheal cuff inflation. Heart rate and mean arterial pressure was measured 45 seconds after induction, after intubation, 2 and 5 min after intubation.

Intubation conditions were excellent in 50% and 84% of Group T and Group P patients which was statistically significant. The reduction in MAP (mean arterial pressure) from baseline to post induction was significantly higher in group P (27.4% ± 11.6) compared with group T (21.8% ± 10.0) and from baseline to post intubation in group P (19.0% ± 16.7) and group T (*vs* 11.2% ± 14.9) were also statistically significant.

The change in % from baseline HR was statistically significant and higher in Group P (13.8% ± 9.7) than in Group T (0.5% ± 12.4) after induction, after intubation (8.7% ± 13.7 in group P *vs* 2.1% ± 13.1 in group T), and 2 minutes after intubation (7.04% ± 14.3 in group P *vs* 3.5% ± 14.3 in group T).

They concluded that propofol-remifentanil-Lidocaine was better than thiopentone- remifentanil – lidocaine for tracheal intubation without neuromuscular blocking agents. Although it causes more hemodynamic instability.

(Can J Anaesth. 2005 Mar;52(3):249-53.)

9. ***Stevens et al.*** compared different doses of remifentanil with propofol induction for tracheal intubation without neuromuscular relaxants.

80 premedicated outpatients belonging to ASA I and II were randomized into four groups. Remifentanil 1, 2, 3, or 4 µg/kg was infused intravenously over 90 seconds in group I -IV. 60 seconds after starting remifentanil infusion, Propofol at a dose of 2 mg/kg over 5 seconds was given. Laryngoscopy and tracheal intubation were assessed 90 seconds after administration of propofol.

Clinically optimal intubation conditions were defined as open vocal cords, jaw relaxation, and the presence of < 2 coughs as intubation response were observed. This was seen in 35% of patients in group I, 75% of pateints in group II, 100% of patients in group III, and 95% of patients in Groups IV respectively.

Intubating conditions that was clinically acceptable were significantly less in Group I compared with other groups.

Excellent intubating conditions were observed in 30% of patients in group I, 50% of patients in group II, 80% of patients in group III, and 80% of patients in Groups IV respectively. Groups III and IV had better intubating conditions compared with Groups I and II.

The average time for resuming to spontaneous ventilation after induction with propofol was less than 5 min in all groups. The percentage of decrease in mean arterial pressure was 16%, 20%, 28%, 26% in group I, II, III, IV immediately before tracheal intubation.

They concluded that premedicated patients with favorable airway can be intubated with excellent or good intubating conditions 90 seconds after the administration of propofol 2 mg/kg and remifentanil 3-4 µg/kg. Remifentanil at a dose of 3 µg/kg and propofol at a dose of 2 mg/kg administered in combination may provide acceptable conditions for tracheal intubation without muscle relaxant. This combination allows the rapid return of spontaneous ventilation**.**

(Anesth Analg 1998; 86: 45–9.)

10. ***Thwaites et al.*** compared sevoflurane versus propofol with succinylcholine for intubation.

The study group consisted of 64 healthy children of age group 3 to 10 yrs who underwent adenotonsillectomy. Induction was done using either 8% sevoflurane in nitrous oxide or propofol at a dose of 3 to 4 mg/kg with succinylcholine at a dose of 2 mg/kg and intubation was performed 150 seconds after induction.

Intubating conditions were scored using Krieg and Copenhagen Consensus Conference (CCC) scores. The trachea was successfully intubated at the first attempt in all patients under clinically acceptable conditions but the scores were significantly better with propofol and succinylcholine.

(Br J Anaesth. 1999 Sep;83(3):410-4.)

11. ***Tsuda et al.*** evaluated tracheal intubation without muscle relaxant with propofol and different doses of fentanyl.

55 adults posted for elective surgery were randomized into four groups and they received fentanyl doses of 0, 2, 3, or 4 µg/kg respectively. 3 minutes after fentanyl administration, propofol at a dose of 2 mg/kg was given for induction. After the loss of consciousness, supplementation with topical lidocaine at a dose of 2 mg/kg was done. Laryngoscopy and tracheal intubation were done after topical lidocaine administration.

Patients without administration of fentanyl had poor intubating conditions. The incidence of movement and persistent coughing with laryngoscopy and intubation were reduced with increasing doses of fentanyl. Visualization of the vocal cord was more likely to be impossible in patients in fentanyl 4 µg/kg group (40%) compared with patients in fentanyl 2 µg/kg group (7%).

There were no significant differences among groups receiving different doses of fentanyl with respect to position of vocal cords . The vocal cords were closed in 26% of patients receiving fentanyl and propofol for intubation.

(Masui. 2001 Oct;50(10):1129-32.)

12. ***Bonnin et al.*** compared target controlled infusion of propofol and sevoflurane for fiberoptic intubation under spontaneous ventilation.

52 patients belonging to ASA I-II were randomized into two groups. Patients were pre-oxygenated for 3 min and they received either tidal volume ventilation with sevoflurane 4% or propofol infusion with a target plasma concentration of 4 mg/l. After 2 min, sevoflurane was increased by 1% every 2 min and propofol infusion was increased by 1 mg/l until there was no reaction during mandibular movement.

This concentration was maintained for 4 min before starting nasotracheal fiberoptic intubation. Oxygen Saturation, heart rate, mean arterial pressure, bispectral index(BIS) were monitored during induction and fiberscopy. The quality of intubation and operator satisfaction were assessed.

There was no difference in BIS values or pulse oximetry during or at the end of induction. Desaturation occurred 5 times during fibreoptic intubation in propofol group and none with sevoflurane group.

They concluded that sevoflurane provides good intubating conditions in patients undergoing fiberoptic intubation without any hypoxemic episodes in spontaneously breathing patients similar to those observed with propofol**.**

(Acta Anaesthesiol Scand. 2007 Jan;51(1):54-9.)

13. ***Striebel et al.*** compared the intubation conditions using propofol and fentanyl without muscle relaxant with the combination of propofol, fentanyl ,succinylcholine and sodium thiopental/succinylcholine.

100 patients of ASA physical status I and II undergoing gynecological surgery were randomized into 4 groups: Group 1 received 100 µg/kg fentanyl, dose of sodium thiopental was

demand adapted,1 mg vecuronium, and succinylcholine 1 mg/kg; Group 2 received 100 µg/kg fentanyl and dose of propofol was demand adapted ;

Group 3 received 200 µg/kg fentanyl and dose of propofol was demand adapted;

Group 4 received 100 µg/kg fentanyl, 1 mg vecuronium, dose of propofol was demand adapted and succinylcholine 1 mg/kg.

Jaw relaxation, glottis visualization, position and movement of vocal cords and patient movement were assessed. Intubation was graded as I-IV by the anaesthetist. Postoperatively all the patients were asked regarding muscle pain which was graded from I - IV. Before, during and after endotracheal intubation, heart rate, arterial blood pressure and arterial haemoglobin oxygen saturation were monitored.

Group I required an average of 5.5 ± 1.2 mg/kg sodium thiopentone. There were no significant differences in group II, III, IV when compared with the dose of propofol which was 2.4, 2.2 and 2 mg/kg. There was no difference with regard to jaw relaxation, glottis visualization and patient movement during

intubation between the groups. Statistically significant difference occurred with regard to the movement and position of vocal cords during intubation (group III was worse than groups I, II, IV) and the patient movement 1 min after intubation (group 2 was worse than group 3). Overall assessment of intubation was worse in group III than group II, IV. Muscle pain experienced postoperatively was worse in group I than group II, III.

They concluded that the use of 100 µg fentanyl, thiopentone sodium and succinylcholine had intubating conditions which was comparable with 100 µg fentanyl plus propofol.

(Anaesthesist. 1995 Dec;44(12):809-17.)

14. ***Gore et al.*** evaluated intubating conditions with propofol given at different doses without neuromuscular blocking agents.

90 patients of ASA I and II patients who were posted for elective surgery were randomly allocated into 3 groups. group I was given propofol 2 mg/kg, group II 2.5 mg/kg, group III 3mg/kg. After premedicating the patient with fentanyl and midazolam and 5 minutes thereafter, propofol was given followed by lignocaine 90 seconds before intubation. Intubation conditions and hemodynamic changes were recorded .

Intubation conditions were excellent in 96.7% of patients in propofol 2.5 mg/kg group and 100% in propofol 3 mg/kg group. They identified that clinically acceptable intubating conditions could be achieved with propofol at a dose of 2.5 mg/kg and 3 mg/kg without significant hemodynamic changes and 100% success could be obtained with 3 mg/kg of propofol.

They concluded that ideal intubating conditions without neuromuscular blocking agents could be achieved with propofol 3 mg/kg, lignocaine 1.5 mg/kg and fentanyl 2 µg/kg without significant hemodynamic alterations.

(J Anaesth Clin Pharmacol 2011;27:27-30.)

15. ***Ko et al.*** aimed at determining the optimal time of injection of fentanyl during induction to reduce hemodynamic response to laryngoscopy and tracheal intubation.

150 patients were randomized into 5 groups. group I was the control group in which the patient was not given fentanyl. Groups II – V received fentanyl at a dose of 2 µg/kg 1, 3, 5, or 10 min before tracheal intubation, respectively.

Blood pressures were not increased in Groups III and IV, except for rise of diastolic blood pressure in Group III, which

was significant after intubation compared with the baseline values. Group I, group II, and group V showed rise in in arterial blood pressure which was significant.

Systolic pressure, diastolic pressure, and mean arterial pressure 1 min after intubation in Group III and group IV were less compared to those in the control group. Heart rate increase in group IV was significantly less compared to the control group but there was no significant difference in Group II, group III, and group V. The number of patients with dysrhythmia and tachycardia was significantly lesser in Group IV than in the control group.

They concluded that the optimal time of injecting fentanyl to attenuate hemodynamic response to laryngoscopy and tracheal intubation is 5 min before tracheal intubation.

(Anesth Analg 1998; 86: 658–61)

METHODOLOGY

After obtaining institutional ethical committee clearance and written informed consent from each patient, 80 patients of ASA physical status I and II scheduled for elective surgery undergoing general anesthesia were included in the study.

It was a prospective, randomised, single blinded study conducted in the Department of Anaesthesiology, Rajiv Gandhi government general hospital, Chennai. The patients who were satisfying the inclusion criteria were enrolled in the study. The patients were randomly allocated into two groups through lots before administering general anesthesia.

Patients were divided into 2 groups, **group S** (n=40) comprised of patients who were given sevoflurane induction and **group P** (n=40) comprised of patients who were given propofol induction.

INCLUSION CRITERIA:

- Age : 15 years and above
- ASA : I & II

- Elective surgery undergoing general anesthesia
- Mallampatti scores : I & II
- Who have given valid informed consent

EXCLUSION CRITERIA:

- Not satisfying inclusion criteria
- Patients posted for emergency surgery
- Patients with difficult airway
- Lack of written informed consent
- Neuromuscular disorders
- Cervical cord injuries
- Severe cardiovascular, central nervous system, hepatic and renal disease
- Patients with increased risk of regurgitation
- Anticipated difficult airway
- Reactive airway disease
- History of drug allergy to the study drugs

MATERIALS:

- Laryngoscopes of various sizes,
- Gum elastic bougie
- Guedel's oropharyngeal airway
- Drugs – propofol, sevoflurane, fentanyl, glycopyrrolate, xylocard, normal saline, inj ephedrine, inj atropine, succinylcholine and other emergency drugs.
- Monitors – ECG,NIBP,SPO2,EtCO2
- 2 cc,5 cc and 10 cc syringe
- 18G intravenous cannula.
- Appropriate size endotracheal tubes

PRIMARY OUTCOME MEASURES:

- Intubating conditions
- Coughing after intubation and cuff inflation
- Cormack lehanne grading
- Apnea after induction

SECONDARY OUTCOME MEASURES:

- Heart rate
- Systolic blood pressure
- Diastolic blood pressure
- Mean arterial pressure

All these parameters were measured at

- Baseline
- Induction
- Immediately after intubation
- 1 minute after intubation
- 5 minute after intubation.

Assessment of Intubating conditions were done using 3 variables :

1. Jaw relaxation
2. Vocal cord position
3. Patient movement during and within 1 min of attempted intubation of the trachea.

Intubating conditions score :

SCORE	***JAW RELAXATION***	***VOCAL CORD POSITION***	***INTUBATING RESPONSE – LIMB MOVEMENT***
OPTIMAL	Fully relaxed	Widely open	None
GOOD	Mild resistance	Mid position	Slight
POOR	Tight but open	Moving but open	Moderate
INADEQUATE	Impossible	Closed	Severe

Coughing after intubation and cuff inflation was graded as:

- None
- Mild
- Moderate
- Severe

Cormack and lehanne grading was graded as :

1 - Visualization of entire vocal cords

2 - Visualization of posterior part of laryngeal aperture

2a - Visualization of posterior part of vocal cords

2b - Visualization of arytenoids only

3 - Visualization of epiglottis

3a – epiglottis liftable

3b – epiglottis adherent or only tip visible

4 - No glottis structures seen

Heart rate,systolic blood pressure and diastolic blood pressure, mean arterial pressure was measured:

- Baseline
- After Induction
- Immediately after intubation
- 1 minute after intubation
- 5 minute after intubation

CONDUCT OF THE STUDY:

The patients enrolled in the study were given Diazepam 10 mg per oral, ranitidine 100 mg per oral and metoclopramide 10 mg per oral 3 hours prior to surgery as premedication. The patients were randomly assigned into two groups through lots before administering general anesthesia. Patients were divided into 2 groups, **group S** (n=40) comprised of patients who were given sevoflurane induction and **group P** (n=40) comprised of patients who were given propofol induction.

All patients were premedicated with Inj. Ondansetron 4 mg iv, Inj.glycopyrrolate 0.2 mg iv in the pre anaesthesia room. After the patient entered the theatre, the patient was placed in the supine position with the head in magill's position.

The patient's vital parameters were monitored using electrocardiogram, non-invasive blood pressure measurements and pulse oximetry. The baseline vital parameters were noted and an 18 gauge cannula was started in the dorsum of hand and 0.9% normal saline of 10 ml/kg was infused in all patients before induction.

The facemask was connected to a semiclosed anesthetic circuit and preoxygenation with 100 % oxygen were done in all patients for 5 min through a face mask which is tight fitting. All patients received fentanyl intravenously at a dose of 2 µg/kg 5 minutes before induction and lignocaine 1.5 mg/kg intravenously 90 seconds before tracheal intubation.

Patients in group P (n=40) received propofol intravenously at a dose of 3 mg/kg over 10 seconds and the anesthesiologist performed the laryngoscopy and tracheal intubation 90 seconds after propofol administration.

Patients in group S (n=40) received sevoflurane induction. The fresh gas flow(FGF) was set at 6 litres/minute with oxygen and nitrous oxide ratio of 40% : 60 % and the patient breathed through a primed breathing circuit with sevoflurane spontaneously starting with the dialed concentration of sevoflurane at 1% and increasing it by 1% every 2 – 3 breaths until the dialed concentration of vaporizer is 8% and the ventilation was assisted to maintain etCO2 between 25 and 35 mmHg.

Tracheal intubation was performed 5 minutes from the start of induction. Laryngoscopy was performed using macintosh blade size 3 and

the anesthesiologist performing the laryngoscopy and intubation would score the intubating conditions as optimal, good, poor, inadequate according to the degree of jaw relaxation, vocal cord position and intubating response.

The patients were intubated with appropriate sized Cuffed endotracheal tubes in both males and females. After tracheal intubation, the tracheal cuff was gently inflated, and anesthesia was maintained with reduced concentration (2%) of sevoflurane in group S and with propofol infusion of 4 mg/kg/hr in group P.

Cough after intubation and after cuff inflation was graded by the anesthesiologist as none, mild, moderate and severe. Cormack lehanne grading and the occurrence of apnea any time during induction was also specified by the anesthesiologist.

Hemodynamic parameters such as heart rate, systolic, diastolic and mean arterial pressure was measured after induction, immediately, 1 minute and 5 minutes after intubation.

When the trachea couldn’t be intubated due to unacceptable intubating conditions or severe coughing or airway obstruction, succinylcholine was given at a dose of 1 mg/kg intravenously and then tracheal intubation was done.

STATISTICAL ANALYSIS

- Results are expressed as mean and standard deviation. All statistical analyses were carried out using SPSS for Windows version 15.0.

- Statistical analysis was carried out student's t-test for parametric data and chi square test, fischer's exact test for non parametric data.

- Heart rate, systolic, diastolic and mean arterial pressure were compared using student's t-test. Intubation scores were compared using fischer's exact test.

- A p value < 0.05 was considered as statistically significant.

- From the data of previous studies, a 30% difference in acceptable intubating conditions between two groups was used for power analysis.

- Also, a type I error of 0.05 as well as a type II error of 0.20 were used in the power analysis. The results of the power analysis showed that a sample size of 38 patients was needed in each group.

OBSERVATION AND RESULTS:

There were no significant difference in terms of age, sex ,height and weight between the two groups. the demographic data is shown in table 1.

Table 1: Demographic data

	Propofol(group 1)	***Sevoflurane(group 2)***	***P value***
Age	32 ± 12.43	33.4 ± 11.48	0.602
Weight	57 ± 9.63	58.12 ± 8.96	0.590
Height	157.5 ± 6.08	158.75 ± 5.99	0.376
Sex			
Male	18	16	
female	22	24	

Intubating conditions score:

The intubating conditions score are depicted in table 2.

- Optimal intubating conditions were present in 21/40 (52.5%) of patients in group P and 37/40 (92.5%) of patients in group S (***P – 0.0001***).
- Good intubating conditions were present in 12/40 (30%) of patients in group P and 3/40 (7.5%) of patients in group S.

- The acceptable intubating conditions as defined by optimal or good intubating conditions were present in 33/40 (82.5%) of patients in group P and 40/40 (100%) of patients in group S (***P – 0.011***).

- Poor intubating conditions were present in 6/40 (15%) of patients in group P whereas there was none in group S.

- There was one patient in group P who had inadequate intubating conditions who was intubated with succinylcholine because of tight jaw, closed vocal cords, and severe coughing following laryngoscopy.

Table 2: Intubating conditions score

	PROPOFOL	***SEVOFLURANE***	***P VALUE***
Int.conditions			
OPTIMAL	21 (52.5%)	37 (92.5%)	***0.0001****
GOOD	12 (30%)	3 (7.5%)	
POOR	6 (15%)	-	
INADEQUATE	1 (2.5%)	-	
SUCCESS RATIO (optimal or good)	33 (82.5%)	40 (100 %)	***0.011****

Cough after intubation and cuff inflation:

- There was no cough after intubation in 62.5% of patients in group P and 90% of patients in group S (***P – 0.026***).

- There was mild coughing or diaphragmatic movement in 20% of patients in group P and 7.5% of patients in group S.

- There was moderate or severe coughing in 17.5% in group P and 2.5% in group S.

- There was no cough after cuff inflation in 47.5% of patients in group P and 75% of patients in group S (***P – 0.013***).

- There was mild cough after cuff inflation in 30% of patients in group P and 22.5% of patients in group S.

- Moderate or severe cough after cuff inflation in group P and S were 22.5% and 2.5%. The data of cough after intubation and cuff inflation are shown in table 3.

Table 3: Cough after intubation and cuff inflation

	PROPOFOL	***SEVOFLURANE***	***P VALUE***
Cough after intubation			
NONE	25 (62.5%)	36 (90%)	***0.026****
MILD	8 (20%)	3 (7.5%)	
MODERATE	6 (15%)	1 (2.5%)	
SEVERE	1 (2.5%)	-	
Cough after cuff inflation			
NONE	19 (47.5%)	30 (75%)	***0.013****
MILD	12 (30 %)	9 (22.5%)	
MODERATE	8 (20%)	1 (2.5%)	
SEVERE	1 (2.5%)	-	

Cormack lehanne grading:

There was no significant difference in the grading of intubation between the 2 groups. The data is shown in table 4.

Table 4: Cormack lehanne grading

	PROPOFOL	***SEVOFLURANE***	***P VALUE***
C/L grade			
1	27	30	0.458
2	11	10	
3	2	-	

Apnea:

There was apnea in 100 % of patients in group P and 12.5% of patients in group S (***P – 0.0001***).

Table 5: Incidence of apnea

	PROPOFOL	***SEVOFLURANE***	***P VALUE***
APNEA			
YES	40(100%)	5(12.5%)	***< 0.0001****
NO	-	35(87.5%)	

Hemodynamic parameters:

- There was no significant difference in the heart rate and systolic blood pressure before, following induction, immediately after intubation, 1 min and 5 minutes after intubation between the 2 groups.

- Diastolic blood pressure decreased significantly 1 min and 5 min after intubation between the 2 groups which is shown in table 6.

- Mean arterial pressure decreased significantly 1 minute and 5 minute after intubation compared with the baseline.

- MAP 1 min after intubation was 78.08 $\pm$ 10.03 mm Hg in group P and 82.82 $\pm$ 10.05 mm Hg in group S. MAP 5 minutes after intubation was 79.95 $\pm$ 11.08 mm Hg in group P and 84.42 $\pm$ 9.61 mm Hg in group S. The data are shown in table 7.

- Although there was reduction in MAP, the mean arterial pressure in both the groups were well maintained above 70 mm Hg. None of the patients required ephedrine or atropine in our study.

Table 6: Heart rate, systolic and diastolic blood pressure

	Propofol (group P)	***Sevoflurane (group S)***
HEART RATE		
Baseline	90.42 ± 18.44	91.42 ± 13.21
After induction	87.75 ± 16.20	87.40 ± 16.35
After intubation	92.28 ± 17.61	91.45 ± 17.59
1 min after intubation	89.95 ± 14.66	88.15 ± 15.03
5 min after intubation	87.78 ± 12.32	84.70 ± 14.48
SYSTOLIC BP		
Baseline	119.35 ± 13.94	122.78 ± 15.37
After induction	98.5 ± 11.48	98.2 ± 13.10
After intubation	105.58 ± 17.60	103.85 ± 17.09
1 min after intubation	101.28 ± 12.88	103.65 ± 14.20
5 min after intubation	101.12 ± 13.77	106.32 ± 12.11
DIASTOLIC BP		
Baseline	78.92 ± 9.05	81.42 ± 8.57
After induction	67.28 ± 9.66	67.18 ± 10.44
After intubation	70.75 ± 11.19	71.75 ± 13.90
1 min after intubation	66.90 ± 9.71	73 ± 9.08*
5 min after intubation	69.18 ± 10.67	74.75 ± 9.36*

Values expressed as mean± SD. *P <0.05

Table 7 : Mean arterial pressure

Mean arterial pressure		
Baseline	92.10 ± 9.85	95.12 ± 10.40
After induction	77.55 ± 9.54	77.55 ± 10.75
After intubation	82.28 ± 12.28	82.02 ± 14.15
1 min after intubation	78.08 ± 10.03	82.82 ± 10.05*
5 min after intubation	79.95 ± 11.08	84.42 ± 9.61*

Values expressed as mean± SD. *P <0.05

DISCUSSION

Our data showed that trachea can be reliably intubated without muscle relaxant with sevoflurane induction and intravenous fentanyl in premedicated healthy adult patients with favorable airway. In our study, patients who received sevoflurane induction and fentanyl 2 µg/kg had better intubating conditions than propofol 3 mg/kg and fentanyl 2 µg/kg. The success ratio of acceptable (optimal to good) intubating conditions was 100 % in sevoflurane group and 82.5 % in propofol group.

Iamaroon and colleagues compared thiopental and succinylcholine versus sevoflurane 8% with nitrous oxide (N20) 66%. The succinylcholine group achieved excellent or good intubating conditions in almost 100 % patients whereas the sevoflurane group with vital capacity induction also achieved the same success rate compared with succinylcholine group.[11] Our results were similar to the results achieved by the sevoflurane group in this study.

Muzi et al. reported that the mean time (95 % CI) for successful tracheal intubating conditions in sevoflurane induction with

66 % nitrous oxide was 4.7 (3.7-5.7 min) and without nitrous oxide was 6.4 (5.1-7.7 min). In our study, we had optimal to good intubating conditions in sevoflurane induction because we used 5 min time interval for induction to intubation which was similar to the results of Muzi et al. The difference is that we used stepwise incremental induction in our study whereas muzi and colleagues used Dixon's up and down technique for induction.[12]

Bonnin et al. studied 52 patients comparing sevoflurane and target controlled propofol infusion for difficult airway with fiberoptic bronchoscope. They concluded that sevoflurane with tidal volume ventilation provided better fiberoptic intubating conditions than propofol. The results related to the intubating conditions and the apneic episodes were almost identical to our study.[13]

Joo et al. studied 56 female patients and reported that remifentanil sevoflurane combination produces excellent intubating conditions which was around 90 % without muscle relaxants in adults. The results of this study resembled our study where the optimal intubating conditions was 92.5 %.[14]

Kimura et al. determined that the MAC- EI (endotracheal intubation) of sevoflurane was 4.52% and the ED95 needed for tracheal intubation was 8.07%.[15] We used 8 % concentration for sevoflurane induction in our study which is supported by the above study.

Batra et al. demonstrated that propofol 3 mg/kg combined with remifentanil 3 µg/kg provided optimal intubating conditions in children.[16]

Andel et al. studied the propofol requirement for laryngoscopic tracheal intubation and fiberoptic intubation. They found that the median requirement for conventional laryngoscopic tracheal intubation was 2.74 ± 1.59 mg/kg and fiberoptic intubation was 1.37 ± 0.59 mg/kg.[17] In our study, we used propofol at a dose of 3 mg/kg which is supported by these studies.

Batra et al. achieved acceptable intubating conditions in 18 out of 20 children (90%) using propofol 3 mg/kg and remifentanil 3 µg/kg.[16]

Andel et al. determined the requirement of the dose of propofol for tracheal intubation by laryngoscopy and fiberoptic

bronchoscopy and he found that jaw relaxation was optimal in 93.75 % of patients.[17]

Grant et al. assessed the intubating conditions in 60 patients who received propofol 2 mg/kg and remifentanil 2 µg/kg and they achieved acceptable intubating conditions in 80% of patients.[18]

Coghlan et al. investigated propofol 2.5 mg/kg and alfentanil 20 µg/kg and achieved successful intubation in 83% of patients.[19]

Robert et al. reported that the equipotent dose of fentanyl and alfentanil was 10 µg/kg and 75 µg/kg.[20] In our study,if the fentanyl dose of 2 µg/kg is compared with the equipotent dose of alfentanil 20 µg/kg in coghlan et al., propofol and fentanyl would be comparable in terms of intubating conditions. The success ratio of the intubating conditions in the propofol group in our study was 82.5%, the results of which were comparable to the previous studies.

The most effective time of injection of fentanyl to attenuate the hemodynamic response to laryngoscopy and intubation had been found to be 5 minutes after its administration because of its peak effect.[21] Hence we administered fentanyl 5 minutes before induction.

Laubie et al. demonstrated that the action of fentanyl is on the solitary nuclei and the nuclei of glossopharyngeal and vagus nerves.[22]

Muzi et al. suggested that the time of induction was significantly shorter in patients who were premedicated with fentanyl or midazolam before induction and they found that fentanyl or midazolam administered intravenously 5 minutes before induction shortened the time to achieve optimal intubating conditions in adults.[23]

Intravenous lignocaine has been shown to suppress cough reflex.[24] ***Yukioka et al.*** reported that intravenous lignocaine used at a dose of 2 mg/kg suppressed cough significantly when given 1 minute before intubation.[25] Several studies showed that there was no significant improvement in the intubating conditions when used alone with induction agent.[26 27] We used intravenous lignocaine in addition to fentanyl in our study due to these reasons.

Pancaro et al. studied 131 women who received incremental concentration or decremental-incremental or fixed concentration of 8% sevoflurane for induction of anesthesia. They

observed that apnea was frequent in the fixed concentration group than the incremental induction group (68 % vs 21%). They concluded that apnea occurred more frequently in the high concentration group than the incremental induction group.[28] In our study, incremental induction of sevoflurane was done and incidence of apnea was 12.5 % which was almost similar to the previous study.

Pean et al. compared sevoflurane and propofol for difficult airway and reported that coughing was present in 74% of patients in propofol group and 54% of patients in sevoflurane group.[9]

D.Karaaslan et al. compared sevoflurane and propofol with remifentanil for tracheal intubation without neuromuscular blocking agents and reported coughing after intubation and cuff inflation in 40% of patients in sevoflurane group and 5% and 10% in propofol group.[29]

Scheller et al. compared propofol 2 mg/kg with various doses of alfentanil and reported 16 out of 60 patients(26%) who coughed once or twice after intubation or cuff inflation and 5 out of 15 (33%) patients in 30 µg/kg alfentanil group necessitated succinylcholine for intubation because of unacceptable intubating conditions.[30]

Taha et al. compared the intubating conditions of propofol and thiopentone and reported that coughing was present in 8% of patients in propofol group.[31]

Iamaroon et al. reported that mild or moderate coughing were present in 21% of patients belonging to sevoflurane group.[11]

Khoury et al. compared propofol with fentanyl versus alfentanil and reported that coughing after intubation in the fentanyl group were present in 15 out of 40 patients (37.5%).[32]

In our study, marginal or poor intubating conditions were present in 7 out of 40 (17.5%) patients of propofol group whereas it was nil in sevoflurane group. Mild or moderate coughing were present in 35% of patients in propofol group and 10% of patients in sevoflurane group. 1 patient in the propofol group had severe coughing and closed glottis which required succinylcholine for tracheal intubation.

We observed a significant fall in the mean and the diastolic blood pressure 1 and 5 minutes after intubation. The drop in diastolic blood pressure 1 min and 5 min after intubation was down to

66.90 ± 9.71 ; 69.18 ± 10.67 mm Hg in propofol group and 73 ± 9.08 ; 74.75 ± 9.36 mm Hg in sevoflurane group.

The drop in mean arterial pressure 1 min and 5 min after intubation was down to 78.08 ± 10.03 ; 79.95 ± 11.08 mm Hg in propofol group and 82.82 ± 10.05 ; 84.42 ± 9.61 mm Hg in sevoflurane group. But the mean arterial pressure was well above 70 mm Hg in all the patients of both the groups. The heart rate and systolic blood pressure in both the groups didn't show any significant changes compared to baseline.

SUMMARY

Comparing the effectiveness of sevoflurane and propofol with fentanyl for tracheal intubation without muscle Relaxant in our study we summarize:

- Optimal intubating conditions were better in sevoflurane – fentanyl (92.5%) combination than propofol – fentanyl (52.5%) combination***.(P – 0.0001).***

- Acceptable (optimal or good) intubating conditions was best with sevoflurane – fentanyl (100%) combination than propofol – fentanyl (82.5%) combination. ***(P – 0.011).***

- Cough after intubation and cuff inflation was least in sevoflurane group than in propofol group. (90% vs 62.5%) – ***P = 0.026*** ; (97.5% vs 77.5%) – ***P = 0.013.***

- Apnea was more pronounced with propofol group (100%) than with sevoflurane group (12.5%) ***(P – 0.0001).***

- There was significant reduction in the mean arterial pressure 1 min and 5 minutes after intubation compared with baseline but the mean arterial pressure was well maintained above 70 mm Hg.

- There was no difference in the heart rate,systolic and diastolic blood pressure between the 2 groups.

CONCLUSION

In conclusion, anaesthetic induction and tracheal intubation without muscle relaxants in premedicated healthy adult patients undergoing elective surgery is better achieved by incremental induction of sevoflurane and fentanyl 2 µg/kg than with propofol 3 mg/kg and fentanyl 2 µg/kg. The intubating conditions were better with sevoflurane – fentanyl – lidocaine combination than propofol –fentanyl - lidocaine. Hemodynamic changes were similar in both the groups.

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INFORMATION TO PARTICIPANTS

Investigator **:**Dr.PremKumar.M

Name of the Participant:

Title **:** **Comparison of sevoflurane and propofol with fentanyl for tracheal Intubation without muscle relaxant**

You are invited to take part in this research study. We have got approval from the IEC. You are asked to participate because you satisfy the eligibility criteria .We want to compare the effectiveness of propofol and Sevoflurane with fentanyl for tracheal intubation without muscle Relaxant.

What is the Purpose of the Research:

This study has been done to compare the effectiveness of propofoland Sevoflurane with fentanyl for tracheal intubation without muscle Relaxant in elective abdominal surgeries. Muscle relaxants usage in general anesthesia can cause prolonged duration and postoperative residual paralysis which may cause respiratory difficulty and further complications in certain conditions like hyperkalemia,cholinesterasedeficiency,burns,penetrating eye injury, myopathies,allergic reactions. This study will be of use in short duration surgeries where muscle relaxant is not needed and difficult airway situations where muscle relaxants are undesirable.

The Study Design:

This study has been done to compare the effectiveness of propofol and Sevoflurane with fentanyl for tracheal intubation without muscle Relaxant in elective abdominal surgeries. Muscle relaxants usage in general anesthesia can cause postoperative residual paralysis which may cause respiratory difficulty and is contraindicated in certain conditions. This study will be of use in those conditions and in short duration surgeries where muscle relaxant is not needed and difficult airway situations where muscle relaxants are undesirable.

Benefits:

With propofol and sevoflurane, there would be better intubating conditions without muscle relaxants and it would be useful in short duration surgeries. It would be useful in difficult airway also because of maintenance of spontaneous ventilation.

Discomforts and risks:

Reduction in heart rate and blood pressure can occur.coughing during intubation can occur.If heart rate reduces then we give inj.Atropine or if blood pressure reduces we give inj.ephedrine. if there is severe coughing during intubation, intubation would be facilitated by muscle relaxant. There is risk of cannot ventilate and cannot intubate situation which can occur in 0.1% of population where emergency airway may be placed like laryngeal mask airway, tracheostomy or cricothyroidotomy

This intervention has been shown to be well tolerated as shown by previous studies. And if you do not want to participate you will have alternative of setting the standard treatment and your safety is our prime concern.

Time :
Date :
Place :

Signature / Thumb Impression of Patient
Patient Name:

Signature of the Investigator : _____

Name of the Investigator : _____

PATIENT CONSENT FORM

Study title : Comparison of sevoflurane and propofol with fentanyl for Tracheal intubation without muscle relaxant

Study centre : Department of Anaesthesiology
Institute of Anesthesiology and critical care,
Madras Medical College
Chennai 600003

Participant name : Age: Sex: I.P.No:

I confirm that i have understood the purpose of procedure for the above study .i had the opportunity to ask questions and all my questions and doubts have been answered to my satisfaction.

I have been explained about the pitfall in the procedure. I have been explained about the safety, advantage and disadvantage of the technique.

I understand that my participation in the study is voluntary and that i am free to withdraw at anytime without giving any reason.

I understand that the investigator ,regulatory authorities and the ethical committee will not need my permission to look at my health records both in respect to current study and any further research that may be conducted in relation to it, even if i withdraw from the study . I understand that my identity will not be revealed in any information released to third parties or published , unless as required under the law . I agree not to restrict the use of any data or results that arise from the study .

Time:

Date: signature / thumb impression of patient

Place: patient name:

Signature of the investigator:

Name of the investigator:

PROFORMA

NAME: **AGE:** **SEX:** **I.P. NO.**

DIAGNOSIS: **WT:** **MMS CLASS:**

SURGERY PERFORMED: **GROUP:**

1. HEMODYNAMICS:

	HR	BP	MAP
BASELINE			
AFTER INDUCTION			
AFTER INTUBATION			
1 MIN AFTER INTUBATION			
5 MIN AFTER INTUBATION			

2. INTUBATING CONDITIONS:

	OPTIMAL	GOOD	POOR	INADEQUATE
JAW RELAXATION				
VOCAL CORD POSITION				
LIMB MOVEMENT				

3. **COUGHING AFTER INTUBATION**

NONE	MILD	MODERATE	SEVERE

4. **COUGHING AFTER CUFF INFLATION**

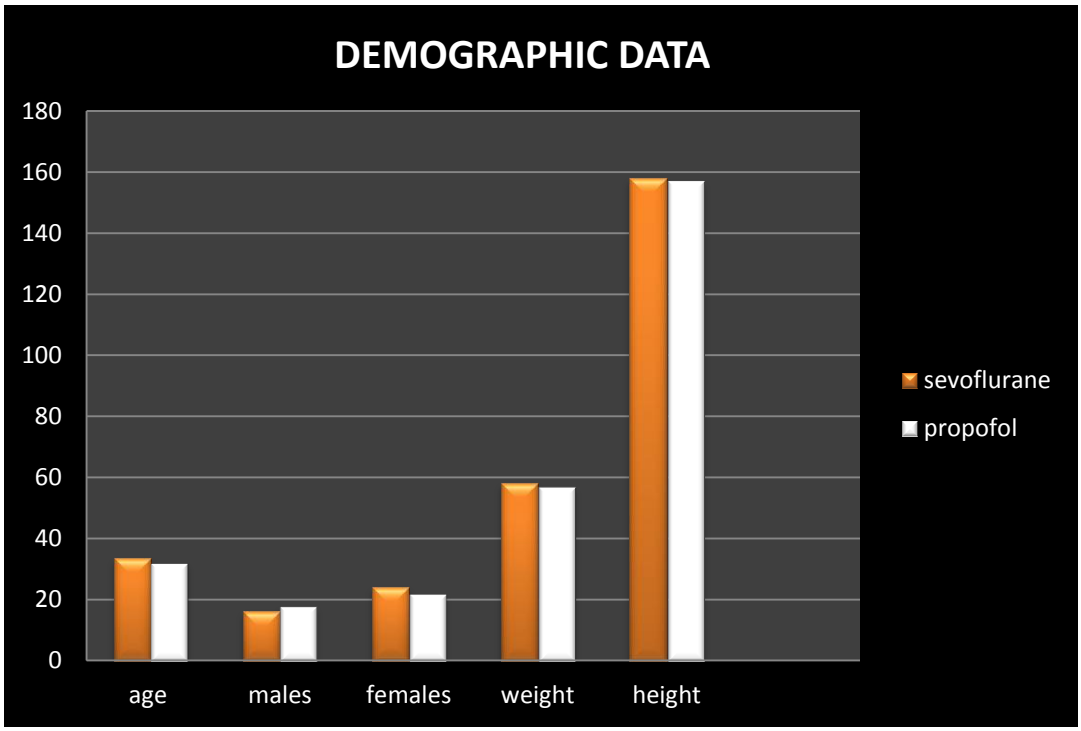
NONE	MILD	MODERATE	SEVERE

5. **C/L GRADE -**

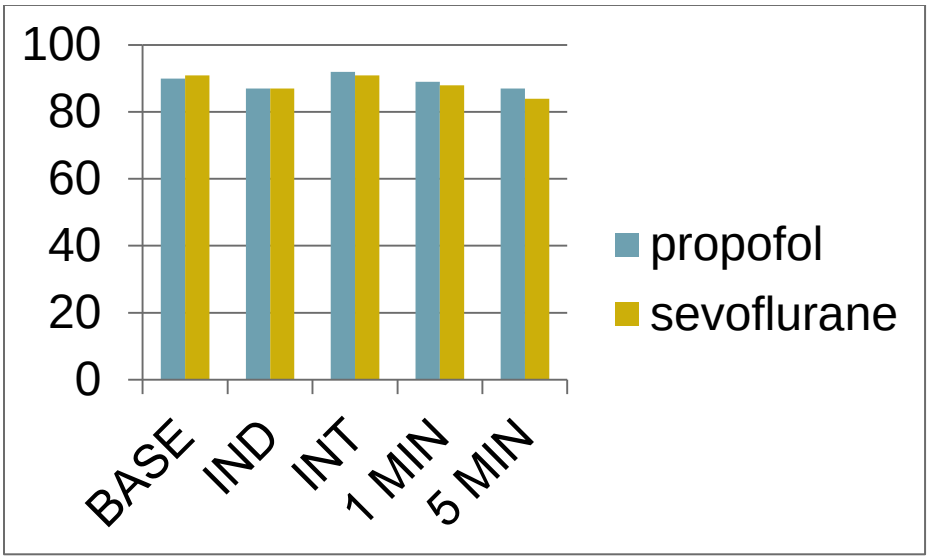
6. **Apnea during induction – yes/no**

GRAPHS

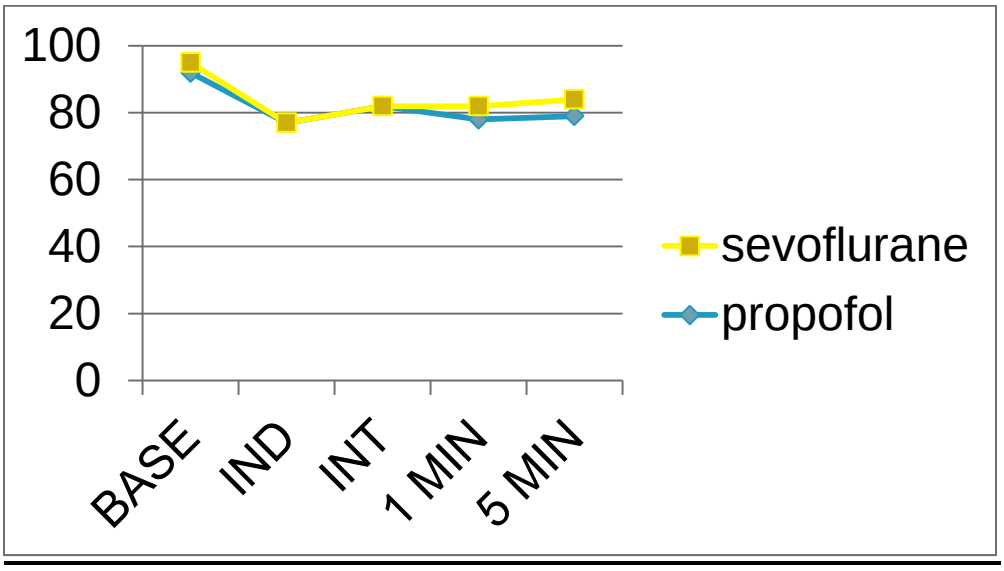
DEMOGRAPHIC PROFILE



HEART RATE

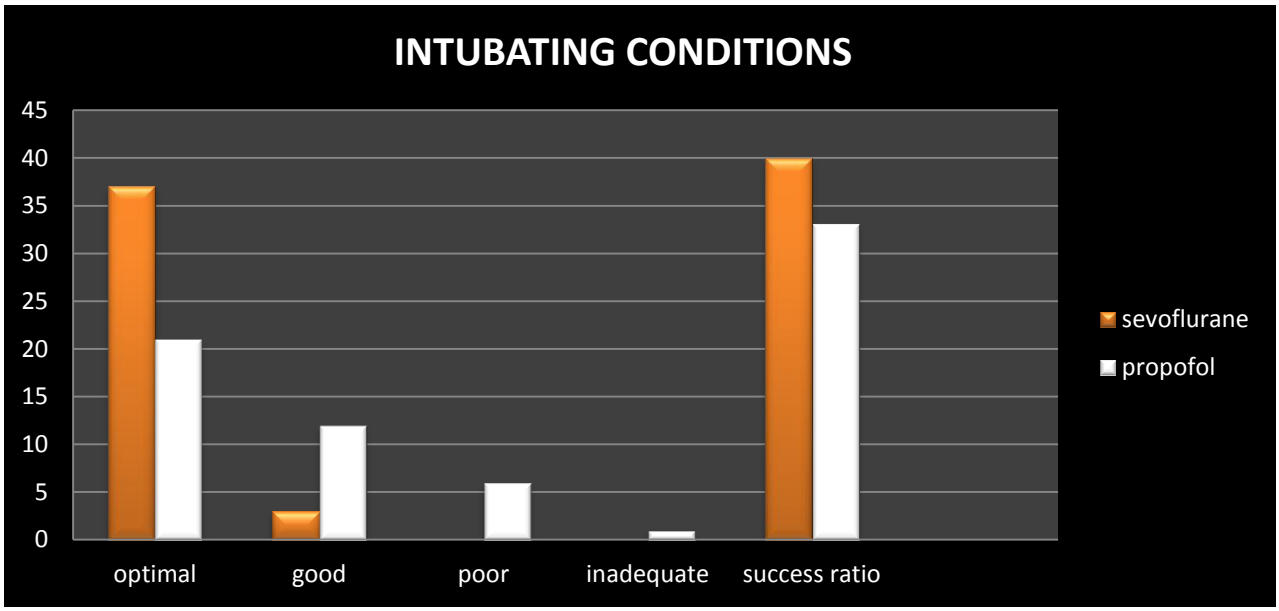


MEAN ARTERIAL PRESSURE



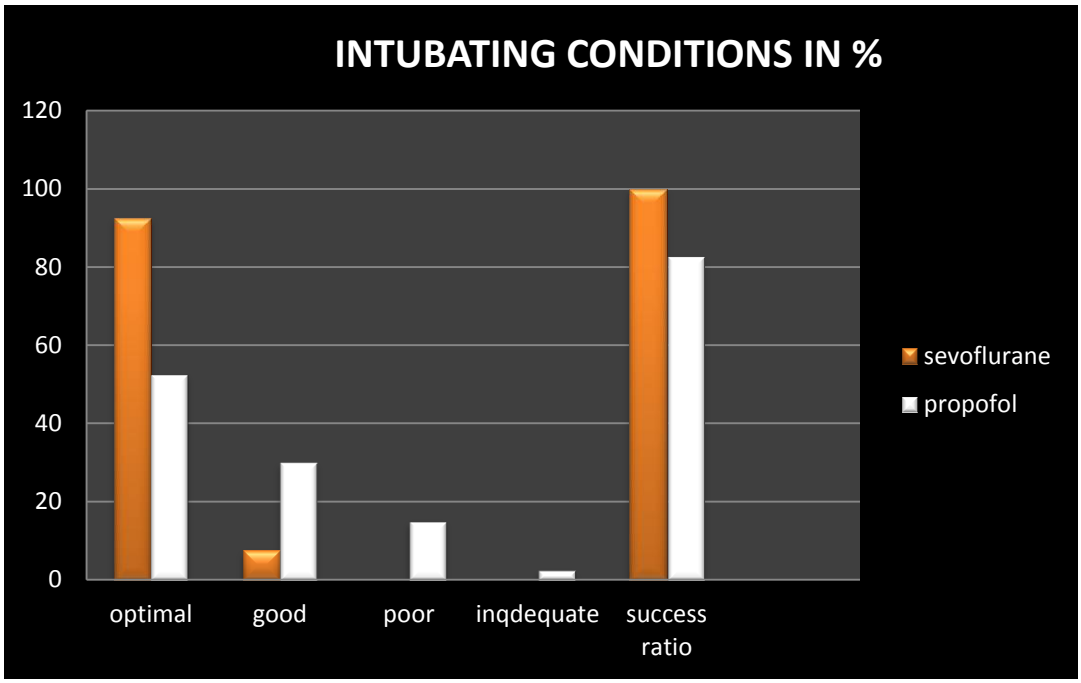
INTUBATING CONDITIONS

NUMBER OF PATIENTS



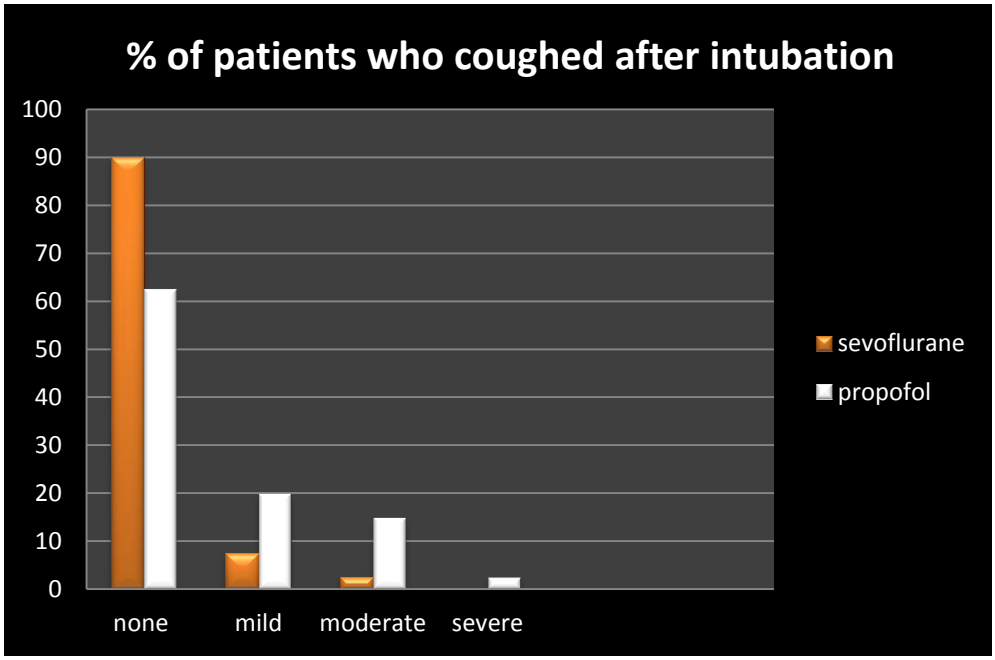
PERCENATAGE (%)

INTUBATING CONDITIONS IN PERCENTAGE



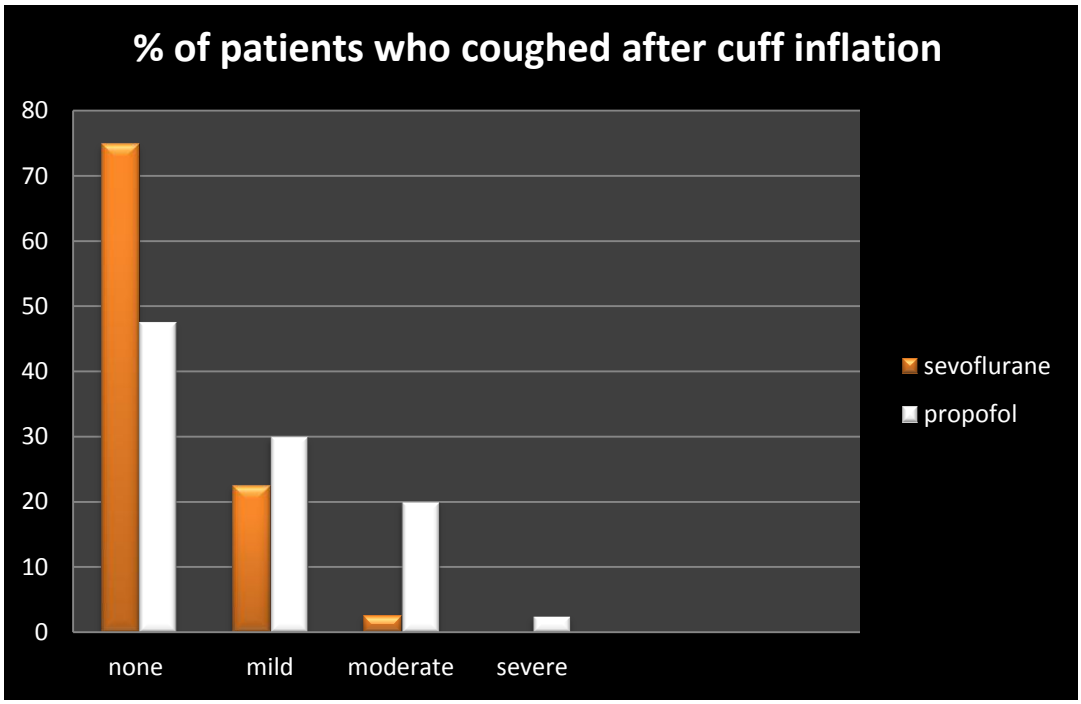
COUGH AFTER INTUBATION

PERCENATAGE (%)



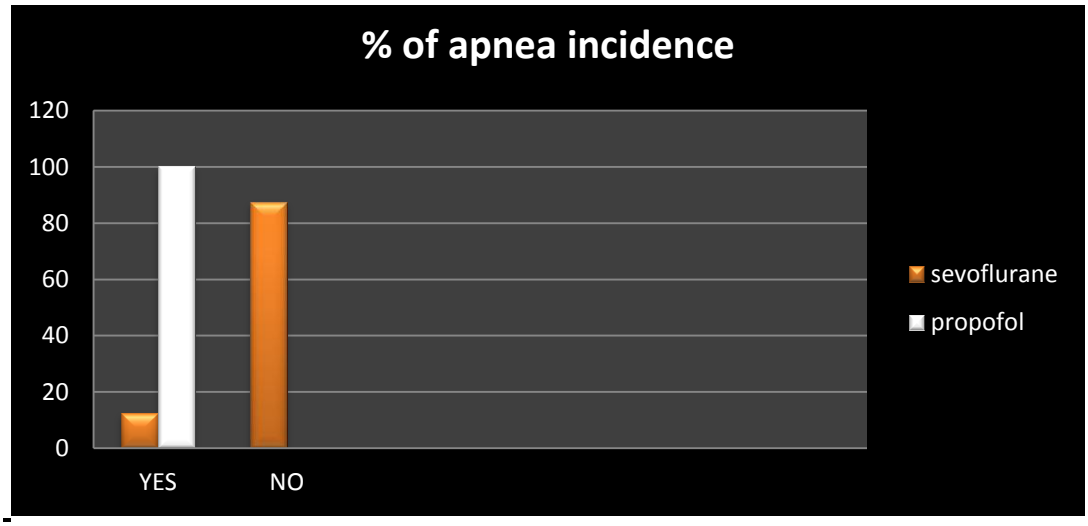
COUGH AFTER CUFF INFLATION

PERCENATAGE (%)



PERCENATAGE (%)

APNEA



HEART RATE :

NAME	AGE	SEX	WEIGHT	HEIGHT	GROUP	HR	BASELINE	AFTER IND	AFTER INT	1 MIN	5 MIN
murugan	40	male	60	158	propofol		80	68	85	74	72
sathya	32	female	60	155	propofol		102	96	98	91	94
vijayalakshmi	26	female	55	156	propofol		93	86	102	96	88
sriram	60	male	65	160	propofol		85	88	72	84	86
krishnan	55	male	70	162	propofol		58	56	80	69	67
poongodi	31	female	65	152	propofol		97	86	74	93	90
mangai	48	female	60	155	propofol		78	80	92	80	82
saranya	20	female	45	145	propofol		93	90	95	118	86
anbalagan	16	male	50	150	propofol		102	85	108	105	109
sivagami	23	female	60	157	propofol		92	94	88	78	82
manikandan	17	male	50	154	propofol		98	81	85	68	70
nivedini	15	female	35	150	propofol		102	96	99	102	97
palani	23	male	60	165	propofol		94	92	97	94	95

kalaivannan	28	male	67	162	propofol		104	102	100	102	102
datchinamoorthy	52	male	58	166	propofol		85	95	70	88	78
chitra	45	female	70	157	propofol		68	74	71	68	76
ilayaraja	26	male	63	164	propofol		71	84	91	86	88
manjula	32	female	63	158	propofol		64	62	90	103	94
prabu	19	male	55	154	propofol		124	107	94	95	92
nagaraj	18	male	60	152	propofol		84	103	124	94	86
rachel	29	female	50	157	propofol		115	130	118	103	90
murugan	46	male	70	166	propofol		103	93	88	104	92
shanthi	23	female	40	160	propofol		135	118	121	112	102
anwar basha	35	male	70	168	propofol		97	85	103	95	70
loganayagi	31	female	60	155	propofol		70	74	71	72	74
backiyam	40	female	55	157	propofol		79	80	85	88	90
vishnupriya	15	female	35	145	propofol		102	88	90	96	101
valliammal	50	female	55	151	propofol		104	93	88	76	103
saraswathi	27	female	50	155	propofol		69	76	78	82	86

andaal	35	female	70	153	propofol		77	78	86	66	68
seenu kumar	30	male	45	158	propofol		118	122	130	119	112
mala	32	female	70	161	propofol		67	68	72	70	75
kala	36	female	50	155	propofol		90	84	102	92	102
sridhar	42	male	60	170	propofol		90	88	107	105	87
lavanya	18	female	40	155	propofol		110	98	120	103	96
suman	24	male	65	168	propofol		47	53	47	61	57
palkish	44	female	60	153	propofol		99	95	94	92	94
mani	55	male	60	167	propofol		107	102	120	104	98
meena	15	female	50	154	propofol		88	92	84	90	96
selvadoss	35	male	54	162	propofol		76	68	72	80	84
rosy	24	female	50	155	sevoflurane		98	104	113	105	100
dhanam	33	female	60	158	sevoflurane		92	98	106	100	98
desammal	40	female	40	162	sevoflurane		84	88	84	86	84
prema	45	female	55	155	sevoflurane		66	60	72	68	60
poongodi	35	female	60	157	sevoflurane		104	98	108	94	92

kamalakannan	24	male	60	165	sevoflurane		90	76	78	76	71
subashini	25	female	50	155	sevoflurane		108	94	104	103	102
anju	25	female	65	161	sevoflurane		101	90	87	93	92
kannagi	45	female	65	150	sevoflurane		92	68	64	72	68
sathyapriya	22	female	40	147	sevoflurane		106	100	104	92	90
kadhar basha	36	male	60	166	sevoflurane		85	82	85	78	76
hema kumar	24	male	70	173	sevoflurane		79	82	84	85	72
sabapathy	40	male	60	163	sevoflurane		103	108	111	108	106
shankari	30	female	70	154	sevoflurane		86	75	80	82	80
velu	48	male	65	161	sevoflurane		96	75	73	76	74
anbu	42	male	65	168	sevoflurane		98	72	81	91	73
parvathi	25	female	40	156	sevoflurane		85	80	95	96	99
nandhini	19	female	50	156	sevoflurane		121	128	124	118	114
ramya	15	female	50	158	sevoflurane		86	85	90	78	82
balan	30	male	60	166	sevoflurane		76	94	83	86	88
kuppan	60	male	60	162	sevoflurane		80	85	90	98	82

vijayan	58	male	65	159	sevoflurane		78	82	110	92	88
jerome	23	male	60	163	sevoflurane		86	92	90	96	92
deepan	28	male	55	158	sevoflurane		102	98	94	91	90
uma	30	female	60	159	sevoflurane		97	92	90	86	76
ramani	28	female	70	151	sevoflurane		82	76	82	76	74
dharmaraj	58	male	75	161	sevoflurane		65	56	52	51	55
shanthi	42	female	60	155	sevoflurane		91	78	100	84	82
kalaivani	25	female	50	158	sevoflurane		80	98	100	84	81
ramzan	35	male	65	175	sevoflurane		95	58	54	56	58
amarvalli	45	female	60	154	sevoflurane		70	64	74	70	72
mymuna	35	female	55	150	sevoflurane		101	98	92	94	92
sangeetha	30	female	50	157	sevoflurane		95	101	110	103	93
hariprasath	16	male	50	161	sevoflurane		110	126	132	122	118
gopi	27	male	60	166	sevoflurane		82	82	76	66	64
karthik	17	male	50	151	sevoflurane		94	88	106	98	88
thilagavathy	38	female	60	154	sevoflurane		117	86	94	90	92

martha david	50	female	80	157	sevoflurane		110	112	112	104	102
jaya	34	female	55	158	sevoflurane		74	71	72	80	76
rajam	30	female	50	155	sevoflurane		92	96	102	98	92

SYSTOLIC BLOOD PRESSURE:

NAME	AGE	SEX	WEIGHT	HEIGHT	GROUP	SYS BP	BASELINE	AFTER IND	AFTER INT	1 MIN	5 MIN
murugan	40	male	60	158	propofol		123	84	91	91	90
sathya	32	female	60	155	propofol		110	90	96	94	100
vijayalakshmi	26	female	55	156	propofol		120	100	104	110	108
sriram	60	male	65	160	propofol		163	140	149	126	106
krishnan	55	male	70	162	propofol		130	97	130	90	100
poongodi	31	female	65	152	propofol		124	103	91	91	96
mangai	48	female	60	155	propofol		110	80	90	100	120
saranya	20	female	45	145	propofol		110	110	100	100	110
anbalagan	16	male	50	150	propofol		100	100	120	120	126
sivagami	23	female	60	157	propofol		129	108	101	97	99
manikandan	17	male	50	154	propofol		118	100	108	108	100
nivedini	15	female	35	150	propofol		100	80	80	85	70
palani	23	male	60	165	propofol		120	100	110	124	100
kalaivannan	28	male	67	162	propofol		140	118	129	109	109
datchinamoorthy	52	male	58	166	propofol		130	90	150	80	80

chitra	45	female	70	157	propofol		116	88	103	86	85
ilayaraja	26	male	63	164	propofol		135	101	110	90	102
manjula	32	female	63	158	propofol		100	98	80	90	100
prabu	19	male	55	154	propofol		120	90	100	94	80
nagaraj	18	male	60	152	propofol		130	100	110	100	100
rachel	29	female	50	157	propofol		120	90	126	110	100
murugan	46	male	70	166	propofol		136	81	73	93	110
shanthi	23	female	40	160	propofol		110	90	92	100	100
anwar basha	35	male	70	168	propofol		103	94	107	104	89
loganayagi	31	female	60	155	propofol		134	113	119	118	98
backiyam	40	female	55	157	propofol		110	100	110	98	90
vishnupriya	15	female	35	145	propofol		130	100	119	100	110
valliammal	50	female	55	151	propofol		141	115	124	90	64
saraswathi	27	female	50	155	propofol		112	110	95	95	97
andaal	35	female	70	153	propofol		95	90	101	90	121
seenu kumar	30	male	45	158	propofol		122	98	94	111	109
mala	32	female	70	161	propofol		130	100	110	110	120
kala	36	female	50	155	propofol		110	100	120	130	110
sridhar	42	male	60	170	propofol		110	100	110	100	90
lavanya	18	female	40	155	propofol		106	85	79	80	97
suman	24	male	65	168	propofol		124	99	97	101	100
palkish	44	female	60	153	propofol		120	110	100	98	110
mani	55	male	60	167	propofol		100	98	121	111	109
meena	15	female	50	154	propofol		110	100	90	130	110
selvadoss	35	male	54	162	propofol		123	90	84	97	130
rosy	24	female	50	155	sevoflurane		104	99	112	104	100
dhanam	33	female	60	158	sevoflurane		127	100	127	124	124

desammal	40	female	40	162	sevoflurane		120	100	110	108	110
prema	45	female	55	155	sevoflurane		100	90	104	99	100
poongodi	35	female	60	157	sevoflurane		112	96	106	100	110
kamalakannan	24	male	60	165	sevoflurane		150	119	106	101	99
subashini	25	female	50	155	sevoflurane		134	93	108	109	124
anju	25	female	65	161	sevoflurane		117	108	119	132	135
kannagi	45	female	65	150	sevoflurane		130	110	90	94	100
sathyapriya	22	female	40	147	sevoflurane		122	88	84	101	110
kadhar basha	36	male	60	166	sevoflurane		133	114	127	117	113
hema kumar	24	male	70	173	sevoflurane		90	80	80	80	90
sabapathy	40	male	60	163	sevoflurane		100	90	100	90	92
shankari	30	female	70	154	sevoflurane		110	90	90	100	108
velu	48	male	65	161	sevoflurane		110	90	94	90	100
anbu	42	male	65	168	sevoflurane		129	97	111	93	88
parvathi	25	female	40	156	sevoflurane		106	87	86	92	109
nandhini	19	female	50	156	sevoflurane		132	106	128	127	121
ramya	15	female	50	158	sevoflurane		115	70	82	119	117
balan	30	male	60	166	sevoflurane		109	88	77	88	94
kuppan	60	male	60	162	sevoflurane		120	100	90	100	110
vijayan	58	male	65	159	sevoflurane		130	96	139	107	110
jerome	23	male	60	163	sevoflurane		100	96	117	115	119
deepan	28	male	55	158	sevoflurane		97	80	95	96	115
uma	30	female	60	159	sevoflurane		121	117	115	113	112
ramani	28	female	70	151	sevoflurane		130	110	90	100	108
dharmaraj	58	male	75	161	sevoflurane		130	110	100	90	110
shanthi	42	female	60	155	sevoflurane		142	135	149	136	133
kalaivani	25	female	50	158	sevoflurane		114	97	116	113	107

ramzan	35	male	65	175	sevoflurane		132	99	88	89	90
amarvalli	45	female	60	154	sevoflurane		166	92	84	91	91
mymuna	35	female	55	150	sevoflurane		130	110	100	92	100
sangeetha	30	female	50	157	sevoflurane		144	97	110	142	124
hariprasath	16	male	50	161	sevoflurane		125	85	94	91	100
gopi	27	male	60	166	sevoflurane		130	90	100	102	94
karthik	17	male	50	151	sevoflurane		130	110	120	100	90
thilagavathy	38	female	60	154	sevoflurane		130	70	110	104	90
martha david	50	female	80	157	sevoflurane		130	110	120	110	106
jaya	34	female	55	158	sevoflurane		130	109	76	97	100
rajam	30	female	50	155	sevoflurane		130	100	100	90	100

DIASTOLIC BLOOD PRESSURE:

NAME	AGE	SEX	WEIGHT	HEIGHT	GROUP	DIAS BP	BASELINE	AFTER IND	AFTER INT	1 MIN	5 MIN
murugan	40	male	60	158	propofol		84	59	60	60	58
sathya	32	female	60	155	propofol		70	60	72	62	70
vijayalakshmi	26	female	55	156	propofol		70	80	80	70	60
sriram	60	male	65	160	propofol		93	98	103	89	77
krishnan	55	male	70	162	propofol		90	60	90	70	72
poongodi	31	female	65	152	propofol		84	60	56	56	66
mangai	48	female	60	155	propofol		80	60	60	70	80
saranya	20	female	45	145	propofol		80	80	70	80	80
anbalagan	16	male	50	150	propofol		80	80	84	80	82
sivagami	23	female	60	157	propofol		87	72	60	58	62
manikandan	17	male	50	154	propofol		70	66	78	70	80
nivedini	15	female	35	150	propofol		80	60	60	62	50
palani	23	male	60	165	propofol		70	60	70	65	62
kalaivannan	28	male	67	162	propofol		90	92	82	59	89
datchinamoorthy	52	male	58	166	propofol		80	70	80	60	60
chitra	45	female	70	157	propofol		78	59	71	58	60
ilayaraja	26	male	63	164	propofol		98	71	70	60	74
manjula	32	female	63	158	propofol		70	66	62	64	68
prabu	19	male	55	154	propofol		70	60	62	60	62
nagaraj	18	male	60	152	propofol		90	70	80	70	62
rachel	29	female	50	157	propofol		70	70	80	60	70

murugan	46	male	70	166	propofol		103	58	55	71	70
shanthi	23	female	40	160	propofol		70	70	64	60	72
anwar basha	35	male	70	168	propofol		69	59	73	72	58
loganayagi	31	female	60	155	propofol		88	66	79	59	57
backiyam	40	female	55	157	propofol		70	66	70	60	70
vishnupriya	15	female	35	145	propofol		80	72	80	76	72
valliammal	50	female	55	151	propofol		77	66	74	63	46
saraswathi	27	female	50	155	propofol		70	69	64	65	65
andaal	35	female	70	153	propofol		68	65	71	64	92
seenu kumar	30	male	45	158	propofol		82	65	68	73	71
mala	32	female	70	161	propofol		90	80	70	80	76
kala	36	female	50	155	propofol		80	62	72	98	78
sridhar	42	male	60	170	propofol		70	62	82	70	60
lavanya	18	female	40	155	propofol		75	56	51	48	67
suman	24	male	65	168	propofol		75	56	54	52	56
palkish	44	female	60	153	propofol		72	82	72	70	68
mani	55	male	60	167	propofol		68	60	86	74	69
meena	15	female	50	154	propofol		80	66	62	72	86
selvadoss	35	male	54	162	propofol		86	58	53	66	90
rosy	24	female	50	155	sevoflurane		78	72	80	76	70
dhanam	33	female	60	158	sevoflurane		86	65	91	83	82
desammal	40	female	40	162	sevoflurane		70	62	72	66	70
prema	45	female	55	155	sevoflurane		68	62	68	72	80
poongodi	35	female	60	157	sevoflurane		76	68	72	76	80
kamalakannan	24	male	60	165	sevoflurane		92	49	64	60	63
subashini	25	female	50	155	sevoflurane		89	57	74	73	91
anju	25	female	65	161	sevoflurane		72	72	72	97	98

kannagi	45	female	65	150	sevoflurane		90	80	70	72	70
sathyapriya	22	female	40	147	sevoflurane		76	51	50	59	80
kadhar basha	36	male	60	166	sevoflurane		85	75	82	71	70
hema kumar	24	male	70	173	sevoflurane		70	60	60	60	70
sabapathy	40	male	60	163	sevoflurane		70	70	72	70	60
shankari	30	female	70	154	sevoflurane		80	70	72	72	66
velu	48	male	65	161	sevoflurane		74	72	60	72	80
anbu	42	male	65	168	sevoflurane		90	71	75	66	66
parvathi	25	female	40	156	sevoflurane		66	52	53	65	88
nandhini	19	female	50	156	sevoflurane		88	72	88	87	83
ramya	15	female	50	158	sevoflurane		72	42	48	83	81
balan	30	male	60	166	sevoflurane		73	59	51	59	60
kuppan	60	male	60	162	sevoflurane		86	70	62	70	84
vijayan	58	male	65	159	sevoflurane		94	73	117	70	68
jerome	23	male	60	163	sevoflurane		70	70	83	83	85
deepan	28	male	55	158	sevoflurane		73	57	72	71	86
uma	30	female	60	159	sevoflurane		77	80	77	70	77
ramani	28	female	70	151	sevoflurane		92	74	76	76	72
dharmaraj	58	male	75	161	sevoflurane		80	74	84	66	72
shanthi	42	female	60	155	sevoflurane		94	92	103	91	90
kalaivani	25	female	50	158	sevoflurane		80	67	81	79	76
ramzan	35	male	65	175	sevoflurane		86	72	68	68	70
amarvalli	45	female	60	154	sevoflurane		99	58	55	64	65
mymuna	35	female	55	150	sevoflurane		92	80	68	70	70
sangeetha	30	female	50	157	sevoflurane		89	60	76	95	81
hariprasath	16	male	50	161	sevoflurane		83	54	73	71	70
gopi	27	male	60	166	sevoflurane		80	66	72	78	60

karthik	17	male	50	151	sevoflurane		80	72	66	70	64
thilagavathy	38	female	60	154	sevoflurane		80	54	70	70	70
martha david	50	female	80	157	sevoflurane		90	86	81	82	84
jaya	34	female	55	158	sevoflurane		87	71	50	67	68
rajam	30	female	50	155	sevoflurane		80	76	62	70	70

MEAN ARTERIAL PRESSURE:

NAME	AGE	SEX	WEIGHT	HEIGHT	GROUP	MAP	BASELINE	AFTER IND	AFTER INT	1 MIN	5 MIN
murugan	40	male	60	158	propofol		97	67	70	70	69
sathya	32	female	60	155	propofol		83	70	80	73	80
vijayalakshmi	26	female	55	156	propofol		87	86	88	83	76
sriram	60	male	65	160	propofol		116	112	118	101	87
krishnan	55	male	70	162	propofol		103	72	103	76	81
poongodi	31	female	65	152	propofol		97	74	68	68	76
mangai	48	female	60	155	propofol		90	66	70	80	93
saranya	20	female	45	145	propofol		90	90	80	86	90
anbalagan	16	male	50	150	propofol		86	86	96	93	97
sivagami	23	female	60	157	propofol		101	84	74	71	74
manikandan	17	male	50	154	propofol		86	77	88	83	86
nivedini	15	female	35	150	propofol		86	67	67	70	57
palani	23	male	60	165	propofol		87	73	83	85	75
kalaivannan	28	male	67	162	propofol		107	101	98	76	96
datchinamoorthy	52	male	58	166	propofol		97	76	103	67	67
chitra	45	female	70	157	propofol		91	69	82	57	68
ilayaraja	26	male	63	164	propofol		110	81	83	70	83
manjula	32	female	63	158	propofol		80	76	68	73	78
prabu	19	male	55	154	propofol		87	70	75	71	68
nagaraj	18	male	60	152	propofol		103	80	90	80	75
rachel	29	female	50	157	propofol		87	76	95	77	80
murugan	46	male	70	166	propofol		114	66	61	78	83

shanthi	23	female	40	160	propofol		83	76	73	73	81
anwar basha	35	male	70	168	propofol		80	71	84	83	68
loganayagi	31	female	60	155	propofol		103	82	92	79	71
backiyam	40	female	55	157	propofol		83	77	83	73	76
vishnupriya	15	female	35	145	propofol		96	81	93	84	84
valliammal	50	female	55	151	propofol		98	82	91	72	52
saraswathi	27	female	50	155	propofol		84	83	74	75	76
andaal	35	female	70	153	propofol		77	73	81	73	102
seenu kumar	30	male	45	158	propofol		95	78	77	86	84
mala	32	female	70	161	propofol		103	86	83	90	90
kala	36	female	50	155	propofol		83	74	88	108	88
sridhar	42	male	60	170	propofol		83	74	91	80	70
lavanya	18	female	40	155	propofol		85	66	60	59	77
suman	24	male	65	168	propofol		91	70	68	68	71
palkish	44	female	60	153	propofol		88	91	81	79	82
mani	55	male	60	167	propofol		79	73	98	86	82
meena	15	female	50	154	propofol		90	77	71	91	94
selvadoss	35	male	54	162	propofol		98	69	63	76	103
rosy	24	female	50	155	sevoflurane		87	81	91	85	80
dhanam	33	female	60	158	sevoflurane		100	77	103	97	96
desammal	40	female	40	162	sevoflurane		87	75	85	80	83
prema	45	female	55	155	sevoflurane		78	71	80	81	86
poongodi	35	female	60	157	sevoflurane		88	77	83	84	90
kamalakannan	24	male	60	165	sevoflurane		111	72	78	74	75
subashini	25	female	50	155	sevoflurane		104	69	85	85	102
anju	25	female	65	161	sevoflurane		87	84	88	109	110
kannagi	45	female	65	150	sevoflurane		103	90	76	79	80

sathyapriya	22	female	40	147	sevoflurane		91	61	60	73	90
kadhar basha	36	male	60	166	sevoflurane		101	88	97	86	84
hema kumar	24	male	70	173	sevoflurane		76	66	66	66	76
sabapathy	40	male	60	163	sevoflurane		80	76	81	76	71
shankari	30	female	70	154	sevoflurane		90	76	78	81	80
velu	48	male	65	161	sevoflurane		86	78	71	78	86
anbu	42	male	65	168	sevoflurane		103	87	87	75	73
parvathi	25	female	40	156	sevoflurane		79	64	64	74	95
nandhini	19	female	50	156	sevoflurane		102	83	88	87	83
ramya	15	female	50	158	sevoflurane		86	51	59	95	93
balan	30	male	60	166	sevoflurane		85	69	60	69	71
kuppan	60	male	60	162	sevoflurane		96	80	71	80	92
vijayan	58	male	65	159	sevoflurane		106	81	124	82	82
jerome	23	male	60	163	sevoflurane		80	79	94	94	96
deepan	28	male	55	158	sevoflurane		81	65	80	79	96
uma	30	female	60	159	sevoflurane		92	92	90	84	89
ramani	28	female	70	151	sevoflurane		105	86	81	84	84
dharmaraj	58	male	75	161	sevoflurane		97	86	89	74	85
shanthi	42	female	60	155	sevoflurane		110	106	118	106	104
kalaivani	25	female	50	158	sevoflurane		91	77	93	90	86
ramzan	35	male	65	175	sevoflurane		101	81	75	75	77
amarvalli	45	female	60	154	sevoflurane		121	69	65	73	73
mymuna	35	female	55	150	sevoflurane		105	90	78	77	80
sangeetha	30	female	50	157	sevoflurane		107	72	87	111	95
hariprasath	16	male	50	161	sevoflurane		97	64	80	78	80
gopi	27	male	60	166	sevoflurane		97	74	81	86	71
karthik	17	male	50	151	sevoflurane		97	84	84	80	73

thilagavathy	38	female	60	154	sevoflurane		97	59	83	81	76
martha david	50	female	80	157	sevoflurane		103	94	94	91	91
jaya	34	female	55	158	sevoflurane		101	84	59	77	79
rajam	30	female	50	155	sevoflurane		97	84	75	77	80

Intubating conditions, cough after intubation and cuff inflation, Cormack lehane grading, apnea:

NAME	AGE	SEX	WEIGHT	HEIGHT	GROUP	INT CON	COUG INT	COUG INF	C/L	APNEA
murugan	40	male	60	158	propofol	good	moderate	moderate	1	yes
sathya	32	female	60	155	propofol	optimal	none	none	2	yes
vijayalakshmi	26	female	55	156	propofol	good	none	mild	1	yes
sriram	60	male	65	160	propofol	marginal	moderate	moderate	3	yes
krishnan	55	male	70	162	propofol	good	mild	mild	3	yes
poongodi	31	female	65	152	propofol	optimal	none	none	1	yes
mangai	48	female	60	155	propofol	optimal	none	none	1	yes
saranya	20	female	45	145	propofol	good	mild	mild	1	yes
anbalagan	16	male	50	150	propofol	poor	severe	severe	1	yes
sivagami	23	female	60	157	propofol	good	mild	mild	1	yes

manikandan	17	male	50	154	propofol	good	mild	mild	1	yes
nivedini	15	female	35	150	propofol	optimal	none	none	1	yes
palani	23	male	60	165	propofol	marginal	mild	moderate	1	yes
kalaivannan	28	male	67	162	propofol	good	mild	mild	1	yes
datchinamoorthy	52	male	58	166	propofol	good	mild	moderate	1	yes
chitra	45	female	70	157	propofol	optimal	none	mild	1	yes
ilayaraja	26	male	63	164	propofol	marginal	moderate	moderate	2	yes
manjula	32	female	63	158	propofol	good	none	mild	2	yes
prabu	19	male	55	154	propofol	optimal	none	none	1	yes
nagaraj	18	male	60	152	propofol	marginal	moderate	moderate	2	yes
rachel	29	female	50	157	propofol	optimal	none	none	1	yes
murugan	46	male	70	166	propofol	optimal	none	none	1	yes
shanthi	23	female	40	160	propofol	optimal	none	none	1	yes
anwar basha	35	male	70	168	propofol	good	none	mild	2	yes
loganayagi	31	female	60	155	propofol	optimal	none	none	2	yes
backiyam	40	female	55	157	propofol	optimal	none	none	1	yes
vishnupriya	15	female	35	145	propofol	optimal	none	none	1	yes
valliammal	50	female	55	151	propofol	optimal	none	none	2	yes
saraswathi	27	female	50	155	propofol	optimal	none	none	1	yes
andaal	35	female	70	153	propofol	optimal	none	none	1	yes
seenu kumar	30	male	45	158	propofol	good	mild	mild	2	yes
mala	32	female	70	161	propofol	optimal	none	none	2	yes
kala	36	female	50	155	propofol	optimal	none	none	1	yes
sridhar	42	male	60	170	propofol	good	none	mild	1	yes
lavanya	18	female	40	155	propofol	marginal	moderate	moderate	1	yes
suman	24	male	65	168	propofol	optimal	none	none	1	yes
palkish	44	female	60	153	propofol	optimal	none	mild	2	yes

mani	55	male	60	167	propofol	marginal	moderate	moderate	2	yes
meena	15	female	50	154	propofol	optimal	none	none	1	yes
selvadoss	35	male	54	162	propofol	optimal	none	none	1	yes
rosy	24	female	50	155	sevoflurane	optimal	none	mild	1	no
dhanam	33	female	60	158	sevoflurane	good	none	mild	2	no
desammal	40	female	40	162	sevoflurane	optimal	none	none	1	no
prema	45	female	55	155	sevoflurane	optimal	none	mild	2	no
poongodi	35	female	60	157	sevoflurane	optimal	none	none	2	no
kamalakannan	24	male	60	165	sevoflurane	optimal	none	none	1	no
subashini	25	female	50	155	sevoflurane	optimal	none	none	1	yes
anju	25	female	65	161	sevoflurane	optimal	none	none	1	no
kannagi	45	female	65	150	sevoflurane	optimal	none	none	1	no
sathyapriya	22	female	40	147	sevoflurane	optimal	none	none	1	no
kadhar basha	36	male	60	166	sevoflurane	optimal	none	none	1	no
hema kumar	24	male	70	173	sevoflurane	optimal	none	none	2	no
sabapathy	40	male	60	163	sevoflurane	optimal	none	none	2	yes
shankari	30	female	70	154	sevoflurane	optimal	none	none	1	no
velu	48	male	65	161	sevoflurane	optimal	none	none	2	no
anbu	42	male	65	168	sevoflurane	optimal	none	none	1	no
parvathi	25	female	40	156	sevoflurane	optimal	none	none	1	no
nandhini	19	female	50	156	sevoflurane	good	moderate	moderate	1	no
ramya	15	female	50	158	sevoflurane	optimal	none	mild	1	no
balan	30	male	60	166	sevoflurane	optimal	none	none	2	no
kuppan	60	male	60	162	sevoflurane	optimal	mild	mild	2	no
vijayan	58	male	65	159	sevoflurane	good	mild	mild	2	yes
jerome	23	male	60	163	sevoflurane	optimal	none	none	1	no
deepan	28	male	55	158	sevoflurane	optimal	none	none	1	no

uma	30	female	60	159	sevoflurane	optimal	none	none	1	no
ramani	28	female	70	151	sevoflurane	optimal	none	none	1	no
dharmaraj	58	male	75	161	sevoflurane	optimal	none	none	1	no
shanthi	42	female	60	155	sevoflurane	optimal	mild	mild	1	yes
kalaivani	25	female	50	158	sevoflurane	optimal	none	none	1	no
ramzan	35	male	65	175	sevoflurane	optimal	none	none	1	no
amarvalli	45	female	60	154	sevoflurane	optimal	none	none	1	no
mymuna	35	female	55	150	sevoflurane	optimal	none	none	1	no
sangeetha	30	female	50	157	sevoflurane	optimal	none	none	1	no
hariprasath	16	male	50	161	sevoflurane	optimal	none	none	1	no
gopi	27	male	60	166	sevoflurane	optimal	none	none	1	no
karthik	17	male	50	151	sevoflurane	optimal	none	mild	1	yes
thilagavathy	38	female	60	154	sevoflurane	optimal	none	none	2	no
martha david	50	female	80	157	sevoflurane	optimal	none	mild	1	no
jaya	34	female	55	158	sevoflurane	optimal	none	none	1	no
rajam	30	female	50	155	sevoflurane	optimal	none	none	1	no